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GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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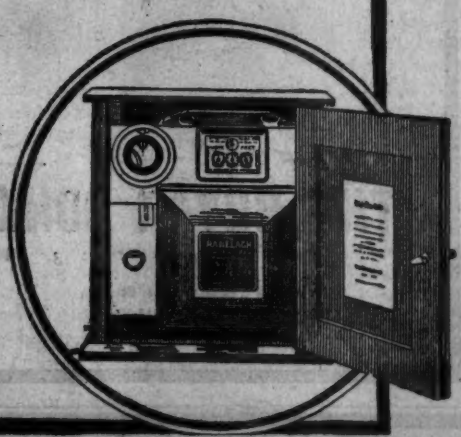

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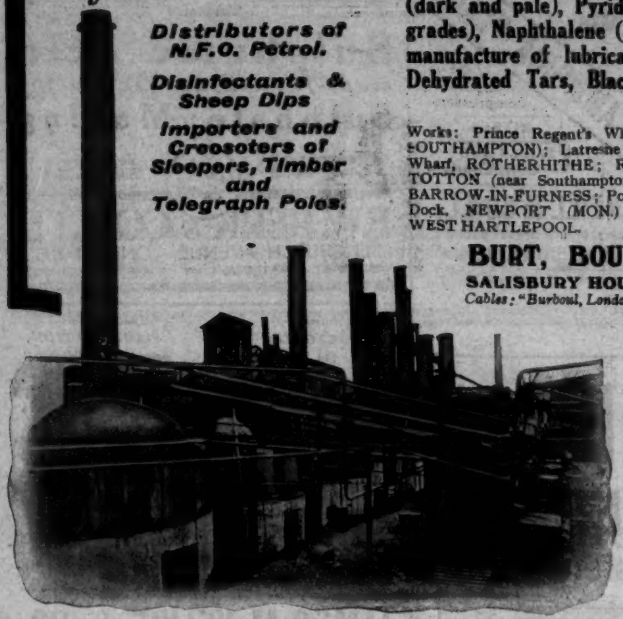

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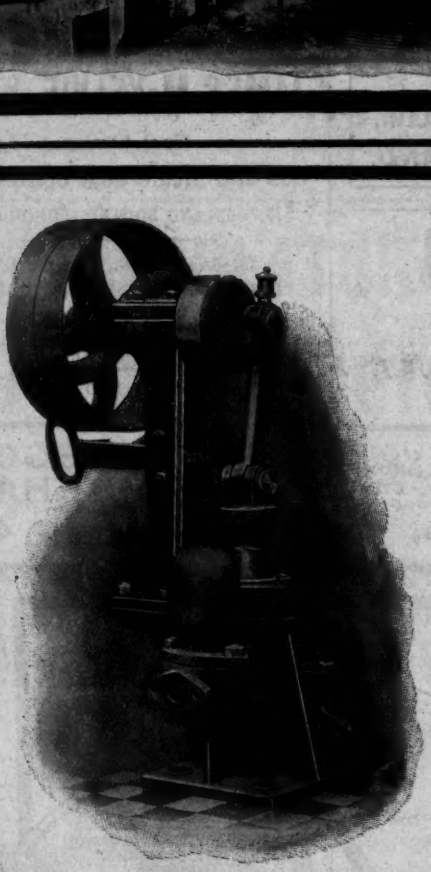

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VOL. CLXVIII., No. 3205.] WEDNESDAY, OCTOBER 15, 1924. [76TH YEAR.

EDITORIAL NOTES.

The Art of Betterment in Industrial Life.

UNUSUAL, but highly important, were two items in the proceedings at the Liverpool meeting of the "B.C.G.A." These were an address by Sir Lawrence Weaver, K.B.E., on "Art in Industry: The Influence of Beauty in Commerce and Industry," and one by the Right Rev. A. A. David, D.D., Lord Bishop of Liverpool, on "The Worker and His Work: Human Relations in an Industrial Age." Both addresses, it is needless to say, were superlative in character, wisdom, and vision, and both treat of questions which are factors of large potentiality in industrial advancement and achievement. They appeal to all industries, though addressed to the gas industry and very applicable to it. They are associated in a stronger sense than may be at first obvious. But their order of delivery we prefer to reverse, seeing that the human factor in industry should have precedence of those things that are produced by the workers' labour and skill. We will, therefore, on this occasion make a few comments on the address of the Lord Bishop of Liverpool, and reserve that of Sir Lawrence Weaver for independent reference.

There is art in things other than those which appeal to the eye. There is art in making full recognition and use of the personal element in industrial life. Had the Lord Bishop of Liverpool been asked to prepare an address bearing upon the art of raising the standard of participation by the worker in industrial life, so as designedly to form a companion deliverance to the eloquent one of Sir Lawrence Weaver, he could not have chosen more apposite lines and method of treatment than he did. The address [*ante* p. 98] is an appeal to a larger audience than the one which heard it; and it demonstrates the good there is in inviting high intellects which are daily being exercised in other spheres of work to scrutinize—not the technicalities of an industry, but the broader conditions which are not peculiar to one industry, but are applicable in some degree to all. As one reads the lecture, the force is felt of an intellectual strength—from one who is a student of human nature, from one who has been the revered head of a great public school, and has had human material upon which to work and to shape—penetrating with practical results into those circumstances which make for a higher industrial life. There is no trace in it of platitude or weakly sentiment; but straight direction to those things which are of great value in industrial work. There is in industry set investigation of technical processes with the view to their improvement; the greatest factor in industry is the human one, but, vital as it is, there is little research into it, but more or less haphazard dealings. The industry with which our readers are associated is cast on such broad foundations, has so many ramifications, and is so complex, that its call upon human skill and activities is of so far-reaching and varied an order that his Lordship found his study of its conditions in relation to its workers a fascinating one. It would indeed be difficult to find an industry which is more so; but what is highly gratifying to those who administrate and direct the industry is that Dr. David finds that in it much is being done to establish those relations which enable men in its component spheres of activity to understand each other better, to raise the dignity of life for all, and to make more secure the industry's best interests. Strife is not dignified; unity is.

Analyzing the address, it is seen that his Lordship's views as to the methods of achieving better human relationships in industry are mainly twofold—educational, and participation in the responsibilities and profits of the industry. In both directions, example has been set by the gas industry. It is pleased to be an example, and to have acknowledgment made of it. It is busy developing its own interests in the very ways in which his Lordship sees advancement. It has now its educational schemes. Education broadens knowledge and capacity, and assists in the adjustment of views as between those occupying different spheres in industry. But that is only part of the work in developing the highest interests. To industry, capital is an essential, and so is labour. Education raises interest in the work; co-partnership creates interest in the welfare of the industry itself. The Lord Bishop applauds what has been done in the industry in this respect; and he is favourable to that complete co-partnership which gives to the workers a share in the responsibilities of direction. It is all educational; it all tends not only to human unity, but to unity of purpose. And that is a great achievement. It creates a new sense and a new atmosphere in a way that nothing else can do. And just as there can be loyalty to oneself and loyalty to an industry, so there is no need on the part of co-partner workers of any disloyalty to their trade union. We have always urged that co-partnership should be part of the policy of trade unions; for in it is a social reform of great magnitude.

Dealing with industrial enterprise in education, his Lordship made one suggestion with which, from the industrial and workers' points of view, we do not, from experience, agree. He said: "I hope that wherever it is possible you "leave the choice of subjects to the men. It makes all the "difference—to the man—whether he is studying something "imposed on him, because somebody else had thought it "good for him, or something that draws him into new joys "of his own." The subject is "The Worker and his Work." In industrial education, the mere fact that it is necessary proves that the men are incapable of choosing the subjects which will be most beneficial to them. They are fully aware of their incapacity in self-prescription; and they ask for guidance from those who have the knowledge. It has to be remembered that they have already chosen their places in industrial life. Their desire, then, to learn is mainly and very properly due to self-interest. They know full well that the gain of efficiency increases the value of their work, and that is the road—the legitimate road—to increased pay and, when opportunity arises, promotion. That testifies to intellect. Their gain, too, is of profit to the industry, for greater competence and efficiency on the part of the workers permeate its whole interests. The betterment of human relations in industrial life lies along clearly defined roads. They may be slow travelling; but there is certainty of result by passing along them.

Modern Purification.

THE members of the Eastern Counties Gas Managers' Association, at their meeting held last Wednesday under the presidency of Mr. F. A. West, of Newark, found that one subject was sufficient to occupy the full time allotted to technical matters. The purification of gas is a question of absorbing interest, and highly important to both supplier and consumer. It is one upon which every gas man can tell of his experiences; and curiously, despite all our theoretical teachings, experiences in this regard fluctuate, and therefore opinions differ as between the management of one works and another. Very small and elusive variations in the conditions ruling between the retorts and foul main and the outlet of the oxide purifier boxes may cause somewhat marked diversity between the practices and results of one works compared with another. In these matters, the state-

ments of one man and those of another have to be taken as actualities within their particular limits, so long as they do not assail fundamental principles; and greater interest would be found in essaying to unravel the mystery of the opposing facts. There was a good deal of experience related in the discussion of the fine paper which Mr. R. A. Weston read on the subject of the latest experiences and practices in respect of the purification of gas at the Norwich works of the British Gas Light Company; and when one remembers that the Engineer of those works is Mr. Thomas Glover, who, when he does and says a thing, has a reason for it, one requires a little hardihood to criticize even an item in practice. Nevertheless, this was done in the discussion, fairly and ably, with the result that the latest practices at Norwich stand precisely where they did, because they are justified by experience. And yet those who work with good issue on differing lines in respect of detail are also justified in their views. Probably the explanation is simply that variations in the conditions of gas production and processes cause the effects of the purification operations to be of an acceptable order. Perhaps some day when we have got past the gas production stage in the work of the Gas Investigation Committee, there may be an exploration of gas purification from its *alpha* to its *omega*.

At Norwich there has been excellent opportunity of investigating the problems in connection with a purification plant of a normal capacity of 3 million c.ft. per day. This deals with the gas from the vertical retort section, and consists of a pair of water-cooled condensers, a centrifugal washer and a rotary washer, and two complete sets of oxide purifiers. The exhausting plant is interposed between the ammonia extraction plant and the oxide purifiers. As is well known, the works are on two different sites, which gives half-a-mile of foul main between the outlet of the ammonia plant and the exhausters. Perhaps it will not be out of place here briefly to mention two or three facts about the procedure. The gas enters the condensers at an average temperature of 160° Fahr., and leaves at an average of 70° Fahr.—the condensers being worked on the counter-current principle. Leaving the condensers, the gas enters the centrifugal washer, the principal function of which is the removal of the tar fog and some ammonia, with the recovery of acid impurities. This washer is fed by gravitation with light tar oils and weak ammoniacal liquor at the rate of ¾ gallon of oil and 2½ gallons of liquor per ton of coal carbonized. The rotary washer-scrubber follows the centrifugal washer for the completion of ammonia removal. Ammoniacal liquor is continually recirculated through the first section of four compartments of the washer by gravitation from overhead tanks at the rate of 1½ gallons per ton of coal carbonized, and clean water is supplied to the second section of four compartments through a low-pressure water meter at the rate of 4 gallons per ton of coal carbonized. That shortly is an outline of the system.

The author discusses the impurities separately—dealing first with tar and tar fog. Of course, tar fog in the ammonia scrubbing plant is very undesirable, and more so in the oxide purifiers, if their efficiency is to be preserved. Looking at the data given in the paper, it is clear that the tar oil used in the centrifugal washer is very effective in removing tar fog, though there still remains some to be dealt with by the subsequent plant. But in the oxide approximately 3 p.ct. by weight of tar is found, which is 50 p.ct. less than has been discovered in samples of oxide from certain other works. However, Norwich is not prepared to say that the centrifugal washer using light tar oils is the last word in the removal of tar fog. "We have not," Mr. Weston said, "succeeded in reducing the fog to a negligible figure;" and he speaks well of the experience with a Livesey washer, also using tar oil, in connection with the horizontal retorts, though no exact quantitative figures can be given. It is seen that the importance of the removal of the tar fog has led Mr. Glover to design a bubbling washer, which in experimental state shows a very high efficiency. The construction is such that, with slotted trays and perforated sections, the gas is subjected to friction and thorough washing. Using crude naphtha, an efficiency of 98·6 p.ct. is realized in the removal of tar fog. This leaves a perfectly negligible quantity in the gas—in fact, it is so near absolute perfection that there is doubt whether anything superior could be achieved. This brings us to a question upon which there is some diversity of opinion—that is, the point at which the tar fog should be removed. The heavier tars and fog should, of course, be abstracted from the gas as early as possible; but the light tar fog, being a naphthalene solvent, should be allowed to go forward (Mr. Weston says) to the outlet of the condensers. With this view, Mr. W. W. Townsend, of Colchester, agrees; there being confirmation in the practice at his own works. In the discussion, experiences differed somewhat as to the effectiveness of the "P. and A." extractor; while in one case mentioned the Everitt tar-extractor had been found efficient. The Livesey washer is preferred by others. It was explained by Mr. Glover that he is using the "Norwich" washer because it brings about better contact of caustic ammonia with the tar acids—thus saving the purifiers, while reducing the tar fog.

Regarding ammonia removal, this is effected by the condensers, centrifugal washer, and rotary washer, and 1 grain goes forward to the purifiers, and is "found beneficial in preserving the activity of the oxide." Dr. Weyman, it will be seen from a paper also published in this issue, considers that the ammonia is not necessary for that purpose. However, that by the way. The process followed for the recovery of ammonia is described in Mr. Weston's paper, as well as that in the case of the horizontal retorts, in which latter, with the system adopted, there is removal of the ammonia down to 1½ grains per 100 c.ft. Both cases show a high efficiency; the former being the superior. As to naphthalene, it is seen that, although the gas from the continuous vertical retorts contains 20 grains per 100 c.ft., and without special provision for dealing with it, the amount passing to the district is only 2 grains, which, having regard to the light oil vapours which go forward, is practically negligible.

Finally, dry purification was dealt with. It is advocated that it should be so worked that, if possible, the usual debit to revenue account should be converted into an appreciable credit. That is something worth aiming for. It involves the sale of the resulting sulphur at its full market value, and the finding of a cheap source of hydrated peroxide of iron. Quality of oxide is also important from both the economic and efficiency points of view. In some works too little consideration is paid to this, though it is such a material factor. The highest possible percentage of iron should be available as hydrated peroxide; and excess moisture, silica, and carbonate of lime, should be shunned. All excess simply occupies good space, and adds to conveyance, handling, and working costs. It is no use buying a bog ore containing 50 p.ct. of moisture if one can be had containing 15 p.ct., which is ample. Every gas engineer will be in agreement with Mr. Weston in the expression of the hope that some method will be devised for preparing oxides for the market, so as to avoid involving the purchaser in unnecessary expenses. It is seen that live steam is used at Norwich for regulating the temperature of the purifiers; but in view of the tendency for the oxide at the cooler end of the plant to increase in moisture content, it is suggested that the material as charged into the boxes should have its moisture content kept down to about 10 p.ct. Steam coils are preferred by many engineers so as to avoid the risk of the oxide becoming highly saturated and depreciated for its purpose. In the paper the hint is given that for the preservation of the chemical activity of the catch boxes, at weekly intervals a quantity of foul gas should be admitted from the main inlet by a suitable by-pass. Many other details are supplied and were discussed in connection with this part of the process—in one respect critically, which suggested a risk. But the risk has not developed at Norwich, and that is the answer to any fear.

The quality of the subject-matter of this paper is as excellent as the manner in which it is presented, and upon it we heartily congratulate Mr. Weston, his chief, and all associated with him in the work which the contribution covers.

The South Bank House in Order—400 B.Th.U. Gas Experiences.

The address which Mr. Samuel Shadbolt, Engineer and Manager of the South Bank and Normanby Gas Company, delivered to the North of England Gas Managers' Association last Friday, is an interesting account of work done, with capability and vision, and with the set purpose of raising the Company's service to a standard of capacity and efficiency for meeting all conditions of demand. A Shadbolt is not worthy of the name who is not original, discriminating, and far-seeing; and the works and operations of the Company served by the President bear evidence that he is all that. He does not say what is within our province to state, that the Company are in a stronger position to-day than prior to

1914 to serve their area, and to maintain that strength, in view of the new order of productive, distributive, and control provision that has been instituted, and this during the years of war and subsequently. This has been accomplished (though there has been an increase of 58 p.ct. in volumetric output) with the capital expended per million c.ft. at no more than the figure at which it stood in 1914—about £530. This is good; but we should have liked the comparison reduced to the thermal basis, seeing that the declared calorific value of the gas to-day is 400 B.Th.U. against in 1914—what? If we say 500 B.Th.U., this would mean an output now of 1,250,000 c.ft. for every million c.ft. prior to 1914. We will not quibble over the point, because in the present position of the Company, through the work carried out, there is an intrinsic value far in excess of that attaching to the position in 1914. But when we investigate the President's succeeding account of what has been done, we think he is hardly logical in saying this preservation of the capital expenditure per million has "only" been possible by the careful selection and use of second-hand plant. Volume of production is the basis over which the capital expenditure is spread; and production volume has more to do with the new Drake carbonization and Tully gasification plants than with subsidiary and second-hand plant—such as condensers, exhausters, Holmes rotary washers, steam-boilers, and other accessories, which, of course, have raised the works efficiency and capacity for dealing with the extra gas made. These items of plant are all essentials; but it is really the higher efficiency of the new gas-making plant, its extra productive capacity, and the lower calorific value of the gas, combined with the greater efficiency of the methods of operation, that enable Mr. Shadbolt to refer to the capital expenditure, after all this work has been carried out, being much the same per million c.ft. as in 1914. Later, the President himself rather discounts the credit previously given to the part played by the second-hand plant in reducing the capital expenditure by stating—after referring to the Drake retort-house installation, with its complete equipment of coal-handling plant, stoking machinery, and gas driven dynamos—that "since then the rapid increase in our gas output has been catered for, with economy in capital outlay, by the installation of a Tully plant in 1920, and a second somewhat larger unit of the same make in 1923."

Passing the information given in the address as to purification and storage accommodation, one comes into contact with the means taken to ensure a higher standard of efficiency in service. Farther on it is seen how the President is a firm believer in uniformity of pressure, composition, and quality being more important factors in good service than a high calorific value. He is right in this. Hence the introduction of booster fans and the establishment of a laboratory. We have heard managers of works of capacities in the region of those of the President assert that these things are not for them; and the confession has given reason for wondering whether it is not rather managerial capacity and ability that are at fault than the scope of the works for incorporating those things that contribute to efficiency and constancy in service. What Mr. Shadbolt can do and find valuable at South Bank, other engineers and managers can do with works of approximately similar capacity. In other ways, too, good service and economy have been promoted. Atomizing sprays (operating on the governor outlets) have been introduced and have relieved trouble from naphthalene deposits; meter repairs are expeditiously done on the works; and there has been a large amount of overhauling and strengthening of the district distributory plant. In every direction, a comprehensiveness is found in the bringing of the works and distributing plant up to a state of very complete service.

As already remarked, the President is supplying a gas of 400 B.Th.U. in his district; and he is very careful to keep it with a level line in respect of composition, but having a good diluent gas, and not one loaded with, or having large variations in respect of, inerts. With this gas he is giving satisfaction. But in this, in our opinion, one important factor is that no less than 66 p.ct. of the gas sold last financial year was to prepayment consumers, to which branch of the business a great deal of attention is being paid, in order to develop custom per meter. Naturally the prepayment installations are under the supervision of the owners of the appliances; and in our view that is a significant factor, with standard types of fittings and appliances, in maintaining satisfaction with a calorific value gas of 400 B.Th.U. The President does not believe in extremes in calorific value; and he addresses some pointed remarks to those who do. "Those who do" are of the few, as testify the calorific values that have been declared throughout the country. There has been a remarkable tendency, after experience, in various cases to retrace steps to a declaration somewhere between 450 and 500. Mr. Shadbolt himself had tried lower grades before determining on 400 B.Th.U. gas for his own district; and he is catholic enough, as all gas engineers should be, to grant that what is suitable for his area may not be so in another with a greater diversity of application. There is, using a diluent of fairly uniform composition, an ability to keep to a very even calorific value line, as is seen from one of the tabulated statements in the address, which shows that the mixed gas in the September quarter of 1923 had a calorific value of 400 B.Th.U.; in the December quarter, 403 B.Th.U.; in the March quarter this year, 406 B.Th.U.; and in the June quarter, 400 B.Th.U. No complaint can be made as to composition (if regard be had to the explanation given in the address as to why the Tully gas for a few months was not up to normal quality), in which connection the President finds very useful the formula given by Mr. W. J. A. Butterfield in the recently issued carbon monoxide report, which enables one to ascertain, from the known volumetric makes, the theoretical carbon monoxide content of the mixed gas.

Regarding naphthalene, the President has a good story of experiment and experience to tell, which, reduced down to few words, shows that he first used a paraffin vaporizer of the gas-heated type, but afterwards transferred practice to the atomizing method. Naphthalene stoppages have been progressively lessened, by using petrol mixed with about 5 to 8 p.ct. of lubricant. A large range of experimental work has satisfied Mr. Shadbolt that the petrols are the most effective of solvents for atomizing for the prevention of naphthalene deposits in the distribution system—the average quantity used being 6 to 6½ gallons per million c.ft. of gas made.

There were several other interesting and instructive points in the useful address, presented purely as the outcome of experience and thought, and not in any dogmatic spirit.

Efficiency of Sulphate of Ammonia Production.

Efficiency in the production of sulphate of ammonia is a subject which is ever with us. It has been discussed over and over again. The losses that occur in the process have been examined from all points of view time after time; but not much progress is made in recovering a larger percentage of the nitrogen content of the coal in the form of pounds of sulphate of ammonia. But even a pound increase per ton of coal means that a works carbonizing 10,000 tons of coal a year would have upwards of 4 tons more sulphate for disposal. The small successes in improvement count for much in the bulk; but this fact, though obvious, somehow seems to escape the consideration of even some responsible officials. The Chief Inspector of Alkali Works is constantly endeavouring to drive home the point of inefficient working. The best sulphate of ammonia results in the gas industry to-day are found in Scotland, where, with vertical retorts and somewhat heavy steaming for gas production, in some cases well over 40 lbs. of sulphate of ammonia is the order of the day. Dr. Geoffrey Weyman, however, in a paper read before the North of England Gas Managers' Association, speaking of ordinary carbonization, does not hold out much hope of any great improvement upon 25 lbs. of sulphate of ammonia leaving a plant into which the equivalent of 26·3 lbs. entered, unless carbonizing conditions can be altered.

Nevertheless, the highest attainable efficiency is an important matter in these times, when sulphate of ammonia resulting from the carbonization of coal has increasing competition to meet; but in ordinary carbonization, Dr. Weyman's study of the matter and the case he presents lead to the one conclusion that, making allowances for the different nitrogen content of coal, improvement in results is only likely by way of attention to those details that are responsible for present losses. It is not much good looking at the distribution, in the products of carbonization, of the original nitrogen in the coal, and bemoaning the large percentage that remains in the coke. Many experimenters have sought to release some of that nitrogen; but it appears practically impossible to do anything of material advantage in this direction without gasification of the carbon. Even then the recovery is comparatively small, and the loss of thermal efficiency great; so

that the game, from what the author says, is not worth the heat expended. But that is a debatable point. However, taking ordinary carbonization practice, Dr. Weyman examines the position to ascertain where, by tuning-up practices and plant, results can be improved. In the first place, before improvement can be effected one has to know where the losses are; and a good survey of the losses is made in the paper. One cause of loss is the decomposition of the ammonia in its long, irregular, and vagrant travel in the retort. But Dr. Weyman raises some amount of hope of partial remedy in this respect when he reminds us that the future may see established some method of carbonizing in which caking coal is blended with non-caking materials. If the fuel is suitably graded, the charge could be kept open, and carbonization could be effected by internal heating. By such means there might be a considerable improvement in the proportion of the ammonia recovered. That is an additional consideration to add to the facilitating, by such practice, of quicker heat transmission through charges, more uniform carbonization, and the various other beneficial attributes which the mixing of non-caking materials with coal charges would, according to theoretical consideration and experimental working, actually produce without making any marked difference to coal throughput. It is rather extraordinary that we have not yet heard of actual experiment on a working scale in this direction, in view of the fact that this appears to be a line of research promising highly profitable results.

Looking into the paper for the lines to be pursued for immediate improvement in sulphate of ammonia results, the frequent bad arrangement of scrubbing plant is marked as indictable. One thing that is not sufficiently realized is that, if ammonia is to be completely recovered, the gas and washing fluid should travel on the counter-current system, and the temperature should not exceed 60° Fahr. Another point often overlooked is that, to obtain a liquor of reasonable strength, a very small quantity of water has to be used for a large quantity of gas; and this brings us to another important point—the best possible devices being employed to distribute the water uniformly over the area of the tower scrubbers, otherwise where gas makes are low much of the gas will pass away without having made contact with the water. This suggests, to secure the highest efficiency, the wisdom of having sets of scrubbers of smaller diameter rather than a large set, so that scrubbing capacity may be regulated to accord with the volume of gas made. Speaking of the efficient centrifugal washers, a point is made by the author which should be noted by the manufacturers. Such washers are not so sensitive to variations of gas make so long as they are not working at less than the critical speed. The makers are charged with being "often unaware of the critical speed;" and yet the washers are rendered useless unless this can be maintained. With rotary washers the speed is also important, in so far as it affects the film of liquid carried by the packing attached to the shaft. In passing, the author criticizes the contention (which also on a previous occasion he attacked) that to allow ammonia to go forward is good for the purifiers. It is not necessary for efficient purification; its presence in the spent oxide is objected to by the acid makers; and if conducted forward to the distributing mains and services, it assists in promoting excessive corrosion. Several other details are mentioned in the paper which are contributory to the attainment of maximum efficiency—such as a gravity feed to stills being preferable to direct pumping; and the liquor entering the stills should be measured in some way—the "Rotameter" being a simple and effective device. The provision of dry steam and a few degrees of superheat is a real economy. The thermal balance of a sulphate plant shows that there is heat to spare, which Mr. P. Parrish uses to pre-heat feed water to boiler plants.

To review anything but the salient points of this well-packed instructive paper, would mean the reproduction of all the detail. This cannot be done here. But it will be seen from the paper itself that a good case is made out for an experimental investigation into the design of saturators, upon which the quality and texture of the salts so much depends. Emphasis, too, is laid upon centrifuging being an operation which demands far more skill and attention than is often given to it—the amount of separation depending upon the relation of speed to the size of the basket. A useful table is given in this connection as to size of baskets and revolutions per minute. The controversial point is discussed as to the material of which the baskets should be composed; and it is mentioned that a recent promising innovation is the substitution of coco-matting or horsehair matting in place of metal gauze. The final part of the paper deals with neutralizing and drying, with comments in this relation upon various practical points which should not be missed. These operations have such commercial advantage, and are recognized and practised so fully to-day, that no one disagrees with them, unless desiring inclusion in the category of diehards or obscurants. The only points of controversy are the system best to be applied, and the details of operation which promote the highest efficiency. Throughout, the paper is one of those which may be described as of supreme practical importance, because of the effect upon raising the general standard of working, which is of advantage not only to individual gas undertakings, but to the industry as a whole.

Dissolution and General Election.

Following the dissolution of Parliament, there is to be a hurried General Election. Polling day is to be on the 29th inst. This haste is attributed to two reasons (or "excuses," some people prefer to call them)—to avoid the municipal elections, and to satisfy the commercial community, who naturally do not want the disturbing influence of a General Election during the Christmas trading period.

Electricity or Gas for Railway Stations.

An interesting feature of the re-lighting arrangements now being installed at the New Street, Birmingham, railway station, is the long-distance control from one central point in connection with the gas-lamps. The scheme is the outcome of long and careful inquiry by the London, Midland, and Scottish Railway as to the most suitable illuminant for railway stations—an important problem on a system which possesses more than 3000 of them. In this instance, the choice lay between electricity and high or low pressure gas; and it was eventually decided to use low-pressure gas for the platforms, yards, and subways, and electric light for the offices and waiting-rooms. The gas-lamps embody the principle of superheated clusters of small inverted mantles, which, in the station itself, will be suspended from the roof tie-rods—thus dispensing with obstructive standards on the platforms.

To Improve the Gas-Fire.

Gas suppliers are not in any respect alarmed over whatever extension there may be in the use of the gas-fire for the replacement of smoke-producing solid fuel. They have at command processes of manufacture which will enable them to make all the gas that is required, and yet co-ordinate the output of secondary products to the demands of the market. So far so good. The well-known authority on heating, Mr. Arthur Barker, B.Sc., B.A., as will be seen by an extract from a lecture on "The Equipment of a Large Country House," states his conviction that in time the gas-fire will completely supersede the ordinary coal fire. But he urges the makers of such fires to do some solid thinking on his criticism of the present type of radiant, which "gets almost white hot, and gives an ugly, uninteresting, intense, and unsympathetic glare, which no person can regard as the equivalent of an open coal fire." Following the solid thinking, there is, if successful, a great prize. If any maker can produce a fire having an efficiency similar to the present one but with an improved radiant, Mr. Barker believes that he will speedily realize a fortune. He considers that the wave length of the light is at present too small (*i.e.*, the light is not red enough), and the mathematical regularity of the radiants is exceedingly irritating, and the pattern ugly. The radiant efficiency is too great, and the convection efficiency too low. It ought also to be possible to switch the fire on and off from the room door. Now what do the makers think of these points? They will have nothing derogatory to say of their critic, because his view is that the heating of a house is incomplete and defective unless every important room has in it a gas-fire of attractive appearance, or at least the possibility of putting in one at short notice.

City and Guilds Examinations.

The reports of the examiners in "Gas Supply" (Mr. H. Kendrick) and in "Gas Fitting" (Mr. R. J. Rogers) are given on later pages in this week's issue. There is still cause on their part for criticism of the defective preparation and theoretical and prac-

tical knowledge of some of the candidates. There are matters in the reports which demand the serious attention of all responsible gas men. For us the greatest disappointment is found in the report by Mr. Rogers.

Census of Production.

In the King's Speech at the prorogation of Parliament, reference was made to the taking of a new Census of Production together with various other inquiries which have been set on foot. His Majesty expressed the hope that these would afford valuable indications of the directions in which the industrial and commercial organization of the country can be improved. We all hope so.

Wembley Next Year.

No strong hopes can be held out that the British Empire Exhibition, as it now exists, will be repeated next year. The papers have during the past week been giving prominent publicity to the arrangements that are being made for the disposal of exhibits; and it is said that it will be the biggest "bargain sale" on record. According to the "Electrician," the electrical manufacturers are averse to carrying on next year; and it holds that to continue the exhibition for another year would be in the nature of an anti-climax. In its view it would be wiser to devote all efforts to a great and united "follow-up"—a campaign in which the electrical lessons of Wembley shall be perpetuated, demonstrated, and (as it were) clinched. "Electrical Industries" supports these views.

Miners and the Outlook.

Nothing has been heard during the past week as to further action on the part of the Coal Miners' Federation to defend the economic position of the miners against reparations coal and the increasing power of Germany in the export coal trade—due partly to the nine-hour working day and the low wages of the miners there. In this country it is the short-hour working and the greater number of men that has to be employed compared with pre-war conditions, which are the chief difficulties of the coal industry. The miners' leaders do not advance any constructive policy; they only talk glibly about Nationalization, as though that is going to alter the relation of conditions in this country to those existing abroad. It is abundantly clear that before long the miners' leaders will have to look fairly and squarely in the face the hard facts existing on the Continent and in this country. Bluster and idiotic obstinacy never did, and never will, alter conditions ungovernable by men. The Miners' Federation would do far better for their members if they got off their self-erected pedestals, and realized that it is beyond their power to bring into line with their policy the economic conditions of the world's coal industries. Until they do this, other men can only smile at their stupid presumption.

Reducing the Ash Content of Coal.

Discussing the reduction of the ash content of high and low grade fuels, Mr. B. F. Haanel, B.Sc., Chief Engineer, Division of Fuel and Fuel Testing, Department of Mines, Ottawa, makes reference to the Trent process; and it is reported that arrangements are being made to instal this at a plant in Eastern Canada for the manufacture of a domestic fuel. The reduction, according to this method, of the ash content of a coal high in ash depends, he says, upon the selective affinity of oil for the carbonaceous matter, and of water for the mineral ash content. To obtain a satisfactory separation of the mineral matter and a complete agglomeration of carbonaceous matter with oil, the coal to be treated must be in a finely-divided condition. The degree of pulverization depends on the reduction in ash content it is desired to obtain. The general practice, however, is to pulverize to about 200 mesh. The pulverized fuel, mixed with a large quantity of water, is placed in a churn (called an amalgamator), and thoroughly agitated. During the period of agitation oil is slowly admitted. The quantity of oil required, while materially differing for different coals, was, according to tests conducted on Canadian coals, in the vicinity of 40 to 45 p.ct. by weight of the coal treated; but this quantity, he has been informed, is now much reduced. When the mixture of oil, water, and finely-divided coal is briskly agitated, the oil and carbonaceous matter begin to agglomerate, and the ash settles in the water. When the operation is complete, a separation of the oil and carbon, in small globules, and the water containing the mineral ash content, is very marked. The time required for making a complete separation varies with different coals, and may be from two to three minutes to fifteen or more minutes with bituminous and anthracite coals.

PERSONAL.

Mr. D. Milne Watson has been elected Chairman of the Association of British Chemical Manufacturers.

Sir Arthur Duckham, K.C.B., M.Inst.C.E., who has been re-elected President of the Institution of Chemical Engineers, has presented to the Institution, as a memento of his Presidency, a seal showing the emblematic watering of the Tree of Knowledge by the Fountain of Chemistry and Engineering.

Dr. E. W. Smith, of British Furnaces, Ltd., has been elected Chairman of the new Section XIII. (Makers of Water Gas Plant) of the Society of British Gas Industries.

The Dundee Corporation Gas Committee last week, after a series of votes, decided to recommend that the Town Council appoint Mr. William Wilson, M.B.E., to succeed Mr. Alexander Yuill (who recently retired) as Gas Engineer and Manager. Mr. Wilson at present holds a similar position at Burton-upon-Trent. The commencing salary is £850, rising to £1050 a year. Mr. Wilson was for some time Assistant at Perth, and has also had experience at Edinburgh, Kirkintilloch, and Falkirk. There were 33 applications for the vacancy.

After seventeen years as Manager of the Oswaldtwistle Gas-Works, Mr. J. H. Davies has resigned the position in order to go abroad—a trip he has had under contemplation for a considerable time. There is general regret at his departure. Under his direction the Oswaldtwistle Works have made great progress.

Mr. Cecil Chapman, Assistant Works Manager of the Provan Chemical Works, Glasgow, has been appointed Manager at these works, in place of Mr. James Picken who has resigned.

ELECTRICITY SUPPLY MEMORANDA.

In the "Memoranda" last week, allusion was made to the increased activity that is being shown by the electricity supply industry in the lighting field. Further evidence of this is obtained from the first of the Salesmanship Conferences arranged by the Electrical Development Association. This was held at the Electric Lamp Manufacturers' Association Lighting Demonstration Department, at 15, Savoy Street, W.C., when Mr. W. E. Bush, representing the Lamp Manufacturers' Association, read a paper on "A Programme for Intensive Lighting Development." If there was little that was new in the composition, it was delightfully presented; and it is found that many of the points in it are as equally applicable to the gas lighting business as to that of electric lighting. Prefacing the paper was a pertinent remark by Mr. W. C. Tapper, the President of the Institution of Electrical Engineers. Referring to the "backward" condition of the electric supply industry of this country as compared with others, he said this was not due entirely to the defects of the industry; for in no country was coal so cheaply obtained, or was a gas supply so cheaply available. It is one of the failings of most electrical men that they will not consider the causes which create differences between this country and another. Just because some other dissimilarly circumstanced countries show average consumptions of electricity far exceeding that of this one, they moan and groan over it, as though equality could be established if only something or other was done; but they do not say what. The electricity industry, in our opinion, has shown and is showing remarkably good enterprise; but that enterprise cannot—unless their commodity and service are markedly superior in all respects to those of competitors—annihilate the latter, particularly when the enterprise of the competitors is also of a high standard. But we confess that in respect of lighting it is not universally so high as it should be. It is, however, improving, and will continue to improve, as more and more undertakings realize the errors of their ways, through the loss that has been occasioned owing to indifference. Genuine public service has no place in it for indifference; and therefore where it exists it cannot be said that there is a full measure of service.

Obstacles to Progress.

The Prize and the Problem.

However, to Mr. Bush's paper. If there are no suggestions in it that are really new, he made his points in such an interesting way that they are likely to be effective in assisting to stimulate electricity salesmen, if supported by the administrative power in each undertaking. In the first place, the author stated that the potential lighting market in the country has been estimated at £400,000,000, excluding the annual revenue to be derived from the sale of energy, or the cost of providing additional generating equipment, switchgear, and the numerous mechanical devices which form an integral part of the modern generating station. Such, said Mr. Bush, is the magnitude of the prize awaiting distribution to the electrical industry. Why await? Why not get on with the distribution? Mr. Bush's manner of expression implies that the taking of possession would be the easiest thing in the world, if only the electrical people were not so lazy in proceeding with the distribution. It sounds simple enough; but Mr. Tapper's prefatory remarks show that there are obstacles of a not negligible order. The succeeding sentence in

the paper indicates that the expression "awaiting distribution" was a pure flight of the imagination; seeing that to arrange a programme which will enable the industry to acquire this valuable prize in the quickest possible time is "the problem which confronts us." It seems to us there is consummate greed and callousness in wishing to acquire the valuable prize in the quickest possible time, if the calculation includes gas, oil, and other lighting agents. Apparently it does, for we read that "the greatest field for expansion is, of course, the electrification of premises which are at present using some other form of illuminant, and, in this class, private houses form the largest proportion." Mr. Bush places the responsibility for the electrification of unwired premises upon supply undertakings and contractors, who alone are in a position to establish direct contact with non-consumers. The proposals which he believes would accelerate progress are defined at some length. Salient features are model electric home exhibitions (with a demonstrator located in each room), and easy payment terms. It is recognized that the proportion of the public who are in a position to lay out in one sum the cost of an installation is comparatively small. Therefore it would appear logical that if the system of payment is made easier, the greater will be the speed of development. If every supply area were to inaugurate a hire-purchase system, the rate of connections would, in Mr. Bush's view, be greatly expedited. That may be; but are the people such as those in view, with fittings for lighting already established, going to incur a new obligation when there is not the slightest necessity for it? We think not. Moreover, it is well known that the cost of electrical installation is heavy; and therefore a hire-purchase scheme would, if based on a short-period repayment, have to be in greater periodical payments than for the cheaper gas installation, or, if based on long-period repayment, the total would amount to considerably more than for a gas installation. Mr. Bush does not consider that the cost of energy is a matter of prime importance, because in his mind "electricity has such an abundance of advantages over its competitors, that a reasonable price can be easily justified and obtained." That is a matter of opinion and experience. It is not only the price per KW.-H., but the quantity that has to be consumed to do an equivalent amount of work to that accomplished by a competitor at a lower cost that has importance, as reflected in the total of the consumers' accounts. It is obvious that Mr. Bush knows more about the technical side of lighting than the commercial side of electricity selling. Those who deal in electricity must smile over the advice and opinions of those mentors who do not come up against the practical difficulties of electricity supply trading. An extensive scope for business is also offered by the better lighting of premises already wired. There we agree. Mr. Bush is also impressed by the work that would result from the education of consumers to higher standards of illumination. But there is no reason for this where the illumination is already adequate, as anything in excess of need is waste. Demonstration of illuminating effects is advocated as the best means of convincing the consumer that poor illumination has disadvantages.

Preparation and Aids. Before attempting to educate the consumer, it is necessary to be assured that the staff engaged on the work have the technical competence for undertaking it. We doubt very much the existence of the competence in many cases. There is too much rule-of-thumb procedure in this lighting installation work—both in gas and electricity. In the first place, Mr. Bush advocates that a series of illumination design courses should be organized for the instruction of electrical representatives. These courses should deal with such subjects as lighting fundamentals, simplified methods of designing illumination schemes, solving special lighting problems, shop lighting, factory lighting, street lighting, modern domestic lighting, flood lighting, electrical advertising, &c. In the discussion, Mr. Bush was questioned on this suggestion; and he intimated that his Association had had under consideration the matter of establishing intensive courses on illumination for the education of salesmen in the industry, but they were not quite satisfied as to whether the trade would support such a scheme. If there was satisfaction on the point, then the Association would go ahead. There was a further suggestion that, in order to assist architects, contractors, and others engaged in planning efficient lighting installations, it is desirable that practical handbooks should be available dealing with all classes of lighting. The information should be so compiled and presented that little or no calculation is necessary in order to plan an efficient lighting scheme. It appears that a series of such handbooks is at present in course of preparation, and will be distributed for the service of the trade in due course. All this shows that things are much alive in the electricity industry in connection with the development of the lighting business. It is to be hoped that gas undertakings which are not actively at work will be stirred from their repose, and proceed to strengthen their hold upon lighting, before through supineness they have more taken from them. The electricity industry is out to capture all it can.

Beware of Eye-strain. This is the title of a circular issued by Condor Lamps (Great Britain), Ltd., who are the makers of a type of lamp which they state has been specially designed to replace gasfilled lamps; and while it gives an equally good light, it does not produce damaging rays. That is as may be; but we are more than a little doubtful on the point. It is not often that one finds electric lamp manufacturers traducing the goods of others. But we take it the Condor people see no harm in saying openly and bluntly what all electric lighting specialists indicate by their practice, if they look after the interests of their clients as well as those of the electricity industry. They provide shields; but the Condor people apparently claim to have achieved something which equals the gasfilled lamp in lighting power, with practically an equal efficiency, a much longer life, and lower first cost. While not denying, we are still doubtful, as "practically an equal efficiency" would demand a practically equal temperature of the filament with all its consequences. The Condor statements go further than the one in the introduction of this paragraph. The Company state: "It is the fashion nowadays for business and other premises to be flooded with light far in excess of actual requirements. This excessive light is frequently obtained from gasfilled lamps. These lamps emit a large amount of highly actinic ultra-violet rays, which are exceeding harmful to the eyes, and may indeed cause permanent damage to the eyesight." Circulars of this kind well distributed ought to be of considerable advantage to the gas supply industry, as well as to the ignorant people who adopt gasfilled and other lamps of high intrinsic brilliance without being warned of their harmfulness to eyesight unless a protector intervenes between the source of light and the organs of vision. A correspondent writing with regard to the circular remarks: "It speaks volumes, from the ranks of the opposition, against existing systems of electric lighting, and undoubtedly pays a tribute to gas lighting, which is free from glare and harmful rays. Perhaps the reason why so many children of the present age have eye weaknesses is due to the facts to which the Condor manufacturers call attention." We agree. It is also due to the same thing that one comes across so many spectacled people in the offices of banks, insurance companies, and other business establishments.

A Sorry Advertisement. Electricity got a little advertisement in the "Daily Mirror" on the 4th inst. There were two companion pictures—and neither of them was attractive. One showed a woman ironing with an electric iron. But no one unless told would have known whether it was an electric or a gas iron. The other picture illustrated a man—presumably an expert—explaining the use of an electric plug. These pictures in the penny daily papers rarely do justice to individuals; and the man who owns the face, the mouth of which is supposed to be giving the explanation, may not be at all proud of its reproduction. As it is printed, it does not look attractive. A sensitive correspondent writing about it says: "It may be prejudice on my part, but I do not like the look of the gentleman who is explaining the use of the electric plug, and would hesitate to admit him to my own dwelling." We are not surprised, but our generosity is such that we are inclined to think it is not a true likeness. However, the pictures are intended to illustrate "Luxury for Threepence." It states that "every small Council house at Barnes is being wired for electric light, and fitted with a special plug which may be used for an electric cleaner, kettle, iron, or similar service. The charge for each such service will be only 3d. per week. It is a venture which deserves success." Upon that point we are not prepared to express an opinion, because we do not know what is comprised in the 3d. Is the 3d. for the use of the iron only? It can hardly be a charge for the current as well, as this is from the lighting circuit; and there could be no discrimination between the current used for lighting and that consumed by the iron. The threepence cannot cover wiring, lighting, and everything else. If it did, the venture clearly would not be a success. A few more details are desirable, in order to ascertain precisely what is meant. Anyway, it is a poor advertisement.

Troubles and Pain. On the evening of last Saturday week, there were inconsiderate people in Preston theatres, cinemas, hotels, and other places who felt unkindly disposed towards the electricity supply. The current in a large section of the centre of the town absented itself from business. It sees no reason why it should not do so; and it is constantly giving evidence of its unconcern for the convenience and pleasure of people who patronize it. Mr. Fred Terry and Miss Julia Neilson, who were presenting "The Marlboroughs" at the Empire Theatre, had to suspend their performance; and the large cinemas, which were packed, were also brought to a standstill. Hotels and other business premises which trust to electricity were also thrown into complete darkness, and had to carry on as best they could with primitive candles, except those who had luckily retained their gas-fittings. A concert at the Conservative Working Men's Club was carried on for two-and-a-half hours by candle light. The streets were not affected, as they are lighted by gas. A curious story comes from Roubaix as to how an elephant figured in an accident which brought to a standstill work in four factories. A visit was paid to the town by a menagerie; and an iron post was driven into the ground to which to tether the elephant. When this had been done, the animal gave vent to yells of pain and rolled on the ground. The struggles of the creature uprooted the post; and then the elephant became placid once more. It was found that the iron post had been driven into an underground electric cable which supplied the four factories with current, to which the misfortune of the elephant was also one for them. Now there is further trouble, as the factory owners are looking round for the right people from whom to recover compensation for the injury occasioned to their business.

ROCHESTER GAS COMPANY'S CENTENARY.

The centenary of the Rochester, Chatham, and Gillingham Gas Company was reached in 1918, but at that time the war rendered impossible the preparation of a brochure to mark the event. This unavoidable omission has, however, now been rectified by the compilation by Mr. C. Valon Bennett (the Engineer, General Manager, and Secretary) of a handsome illustrated booklet, which will enable proprietors and others interested to become acquainted with the principal facts relating to the history of the undertaking, and more particularly the present extent of its operations.

Historical.

The Company was formed in the year 1818, with the title "The Rochester and Chatham Gas Light Company," the original capital being £12,000. The undertaking was incorporated as the Rochester, Chatham, and Strood Gas Light Company by Special Act in 1825. Further powers were obtained by Act in 1867, but the title remained the same until 1906, when it was changed to the Rochester, Chatham, and Gillingham Gas Company. Until 1854 the town of Gillingham was supplied with gas by a separate Company, but in that year the Rochester Company purchased the Gillingham undertaking. Gas was first supplied to Rochester and Chatham in 1819, and the first public street lamps lighted by gas in 1824 were situated in Minor Canon Row, Rochester. The first record of gas being sold by meter was to St. John's Church, Chatham, in 1829, the charge then being 15s. per 1000 c.ft.

A share certificate dated 1818, and a gas account of 1839, are reproduced.

General Particulars.

There are two manufacturing stations, one at Rochester and the other at Gillingham. The area of supply covers 46 square miles, and includes the City of Rochester and the Boroughs of Chatham and Gillingham. Within the area are also Strood, Higham, and Rainham; the population being about 150,000.

There are 125 miles of main varying from 3 in. to 24 in. in diameter, and 24,868 consumers of gas, of whom 10,981 are ordinary and 13,887 prepayment. There are 14,978 gas cooking stoves in use, which are the property of the Company, in addition to those owned privately by consumers. Except within the Borough of Gillingham (where the Corporation are the suppliers of electricity), practically the whole of the public streets are lighted by gas lamps, of which there are 1407 in use. Rochester Bridge is lighted by high-pressure gas.

The progress of the Company during recent years will be readily seen from the under-mentioned figures:

Year Ended Dec. 31.	Gas Made, C.Ft.
1888	324,668,000
1898	445,203,000
1908	493,505,000
1918	753,285,000
1923	827,903,000

The total issued capital of the Company (whose Chairman is Alderman E. W. Willis, J.P.) is now £357,963.

Rochester Works.

These works are situated on the River Medway, below Rochester Bridge. The total area of land owned by the Company is 21 acres, but only 5¾ acres are at present occupied, leaving room for extensions sufficient for many years. The value of this land is greatly enhanced by its having a river frontage of no less than 513 yds. Safe berths for coal vessels carrying 1700 tons are available, if necessary; but at present ships are unloaded at Cory's Wharf, Rochester, and laden barges are brought alongside the Company's wharf, where they are discharged by steam crane.

Coal Carbonizing Plant.

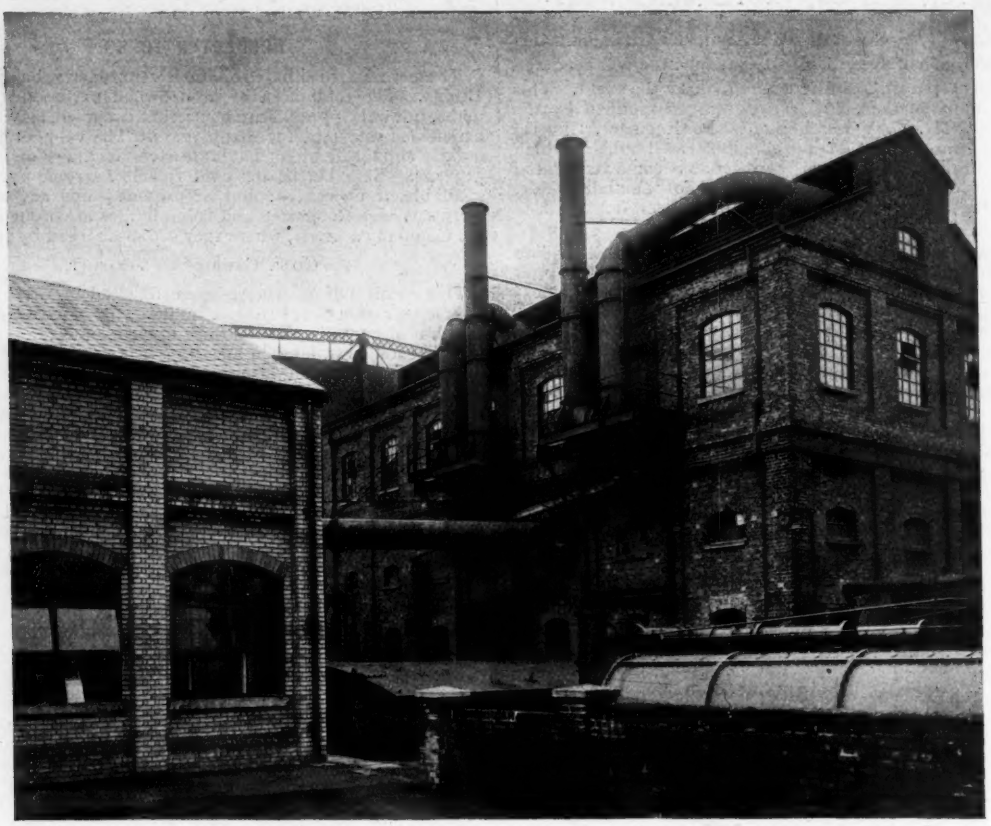
This consists of one retort-house (erected in 1911) capable of producing rather more than a million c.ft. of coal gas per day. The house contains nine settings of horizontal retorts with eight retorts, each 20 ft. long, in a setting, making a total of 72 retorts, which are charged and discharged by electrically driven stoking machines. The coke, when discharged from the retorts, falls through openings in the stage floor into barrows below, and after quenching is removed to the coke storage yard. It is contemplated that machinery for removing coke from the retort-house shall be installed at some not far distant date. The ashes and clinkers from the furnaces are wheeled to a coke recovery plant, where the combustible matter is separated out. This fuel is burned under the works boilers, and the clinkers are sold.

The annular condensers consist of a battery of eight pipes 36 in. in diameter, the washing plant comprises two Livesey washers, and scrubbing is effected in a Clapham rotary washer-scrubber. There are four purifiers, each measuring 35 ft. by 20 ft. by 6 ft. 4 in. deep; and the oxide of iron is prepared by an electrically driven oxide disintegrator.

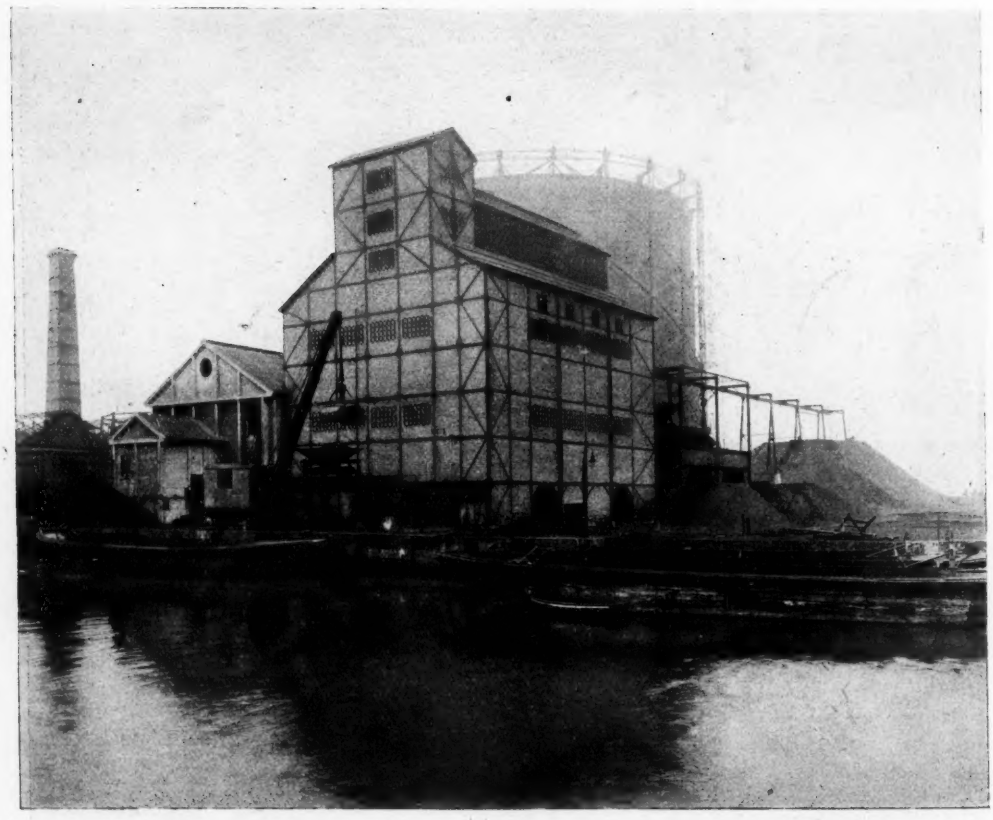
Carburetted Water Gas Plant.

Carburetted water gas has been produced at these works since 1906, when two plants, each capable of making 750,000 c.ft. a day, were erected on the only portion of land then available, which was a considerable distance from the coke storage yard, thus rendering it necessary to employ a large amount of labour in taking the required fuel to them. In 1922 it was decided to put down two new sets (by Messrs. Humphreys & Glasgow), each producing 1,250,000 c.ft. per diem, and to erect them in an old retort-house which is so situated that the stokers wheel coke direct from the retorts to the water gas plant, thus saving all labour costs under this heading. To erect the plant it was necessary for the walls of the building to be raised 13 ft. 6 in. This was done without removing the roof, for by means of hydraulic jacks it was lifted as the walls were heightened. These plants are fitted with waste-heat boilers, and sufficient steam is generated to run the whole of the plant.

ROCHESTER BRIDGE LIGHTING, 1914.



CARBURETTED WATER GAS HOUSE—SHOWING BLAST PRODUCTS PURIFIERS ON SIDE OF BUILDING.



VIEW OF RETORT HOUSE—COAL LIGHTERS DISCHARGING IN THE FOREGROUND.

INTERIOR OF THE ROCHESTER SHOWROOMS.

INTERIOR OF THE GILLINGHAM SHOWROOMS AT NIGHT.

The carburetted water gas meets the coal gas at the inlet to the coal gas condensers, thus ensuring complete mixing.

The boiler house is situated near the engine room and carburetted water gas plant, and also near the coke storage ground, which saves a considerable amount of fuel and labour.

Engine Room and Machinery House.

This building was erected in 1923, and its dimensions are 59 ft. by 40 ft. The walls have white tiles to a height of 6 ft. 6 in., and the floor is finished with black and terra-cotta tiles. All pipes are arranged in brick trenches covered with chequered plates, allowing immediate access when necessary. Here are housed two steam engines direct-coupled to two gas exhausters, each capable of dealing with 80,000 c.ft. of gas an hour. A smaller engine and exhauster are also installed. There are three gas-engine driven sets for the production of electricity for the various machines on the works. The two steam turbines and blowers necessary for the carburetted water gas plant are also situated within this building, and there is sufficient room to receive additional engines when necessary.

Storage, &c.

The station meter is of a capacity of 100,000 c.ft. an hour, and the two holders are capable of containing 1,050,000 c.ft. of gas. The tanks of these holders are of steel, and are of the annular type, being partly above ground. The two station governors are of the water loading type, and have 24-in. connections.

An excellent men's messroom is fitted for gas cooking; and there is provision for both hot and cold baths.

A well has recently been sunk to a depth of 741 ft, enabling pure soft water to be obtained from the Lower Green Sands. This water rises (without pumping) to a height above ground level, and discharges 36,000 gallons per day. A reinforced concrete tank, holding 75,000 gallons, has been built for water storage purposes. There is a properly equipped laboratory, where all the necessary chemical tests and investigations are executed; and a machine shop is fitted with power lathes, screwing and drilling machines, &c. A tar dehydration plant is in use for the preparation of tar for road purposes.

The quantity of gas produced at these works during the year ended Dec. 31, 1923, was 409,001,000 c.ft.

GILLINGHAM WORKS.

These works, occupying an area of 8 acres, are situated in the old part of the town and upon the River Medway below H.M. Dockyard, Chatham. Barges can be brought alongside the Company's wharf at ordinary spring tides. These boats are unloaded by electric crane, and the grab discharges into a receiving hopper situated immediately over a tray conveyor, which carries the coal to the coal crusher, and thence, by a system of gravity bucket and push-plate conveyors, either to the coal store or direct to bunkers over the vertical retort bench. An automatic weighing and totalizing machine is interposed in the tray conveyor to record the weight of coal received. The whole of this plant was put into operation in 1915.

Vertical Retort-House, Coal Store, and Coke Handling Plant.

In order to meet the increasing demand for gas, in 1914 it was decided to provide new coal carbonizing plant. The installation consists of four settings of Glover-West vertical retorts, with eight retorts per setting, capable of producing 1,250,000 c.ft. per day. The coal store, capacity 1500 tons, erected at the same time as the retort-house, is of reinforced concrete, and is encircled by a gravity-bucket conveyor.

Until 1916 there were two circular water-cooled condensers; but owing to the increased quantity of gas made, it was found necessary to erect a further two in that year. These have been so constructed as to enable either air or water to be employed as the cooling medium. The effective capacity of this plant is 2,500,000 c.ft. per day.

Engine Room and Machinery House.

This building was erected in 1915, and is 78 ft. long by 44 ft. wide. The walls and floor are finished in tiles, as at the Rochester Works. The following machinery has been installed: Two coal-gas exhausters and steam engines, each dealing with 80,000 c.ft. per hour; two exhausters and steam engines, each dealing with 25,000 c.ft. of carburetted water gas per hour; one high-speed vertical engine and blower for carburetted water gas plant; one steam turbine and blower; two "Sisson" steam engines and dynamos for the production of electricity; and one gas-engine driven 46 kw. electrical set. The switchboard is composed of three polished marble panels. The positions of the various machines referred to have been so planned as to render it easy for any additional plant to be installed in the future.

Washing, Scrubbing, and Purifying Plant.

Two Livesey washers and a Holmes washer-scrubber were erected in 1916, owing to the then existing plant not being sufficiently large to deal with the quantity of gas manufactured. The machines now in use are capable of dealing effectively with 2,500,000 c.ft. per day. There are, in all, ten purifiers at these works; eight of them being 20 ft. square, and the others 40 ft. square. Four of the small boxes were, until recently, used for the purification of carburetted water gas only. The two large purifiers were put into action in 1922, and are of the latest type. A disintegrator, as at the Rochester Works, is employed for preparing the oxide of iron for use in the purifiers.

There are two carburetted water gas plants, each capable of producing 500,000 c.ft. per day.

Storage, &c.

The total storage capacity of the three holders at these works is 1,985,000 c.ft. The largest was erected by Messrs. S. Cutler and Sons in 1913-14, and is capable of holding 1,500,000 c.ft. of gas. The tank for this holder is of steel and is entirely above ground. It is built upon a reinforced concrete raft, 145 ft. in diameter, which is supported on no less than 317 reinforced concrete piles, some of which were driven 66 ft. below ground level before the required set could be obtained. A tar dehydration plant, dealing with 3600 gallons of tar per day, was erected in 1917. The men's messroom was erected in 1916, and is fitted in the same manner as the one at Rochester.

At these works 418,902,000 c.ft. of gas were manufactured in 1923.

Offices and Showrooms.

The head offices and showrooms are situated at No. 95, High Street, Rochester. The cashier's counter is so situated that it is necessary for persons when approaching and leaving to pass between gas consuming appliances, which are displayed under attractive conditions. A portion of the showroom has been set apart for gas cooking stoves.

The provision of showrooms in Rochester having proved of such considerable benefit to the Company, as well as to the public, property was secured at Victoria Bridge, Gillingham, which is in the heart of the shopping area; and after entirely redecorating the premises and carrying out structural alterations, they were opened as showrooms in 1922. Some idea of the extent of these can be gained when it is stated that the total length of the display windows is 106 ft.

When it is borne in mind that practically the whole of the works have been rebuilt and the undertaking re-organized during the last eleven years (most of which took place during the war period, when labour and material were at a premium), it will be realized that the Directors are men determined that gas to this important naval, military, and industrial area shall be produced and distributed in the best possible manner. Knowing as we do the enormity of the task, it reflects the highest possible credit upon Mr. Bennett (who, in addition to being Engineer, General Manager, and Secretary of the Company, is well known as an active member of the Committee of almost every important organization connected with the gas industry) that he has been able to carry out such work since his appointment in 1913.

Three-Part Gas Rate.

The Doherty three-part gas rate was again discussed at the last annual meeting of the Michigan Gas Association, in a paper presented by Mr. D. E. Byerly, of Adrian (Mich.). This rate recognizes three distinct classes of expenses—those proportional to the number of customers, those proportional to the customers' demand, and those proportional to the actual number of cubic feet produced—and includes three charges covering these classes of expenses. The customers' charge covers all expenses which increase proportionately to the number of customers obtained, and which have no relation to the maximum demand of the customers on their consumption. The demand charge covers all expenses such as investment in plant of sufficient capacity to carry the maximum load caused by the customers, but bearing no relation to the number of customers or their consumption. The consumption charge covers all expenses which vary with the output of the plant, and which bear no relation to whether that consumption occurred in one hour or ten hours, or to the number of customers to whom it was delivered. This rate, the author said, eliminates any discrimination among customers, and thus causes each customer to carry his share of the cost. Unreasonable demands or consumption on the part of one class of consumer will not place a burden on the customers who are reasonable in their demands for service. It acts automatically in rewarding the customer for a good load factor. It is the best rate to use under the competitive conditions in industrial business, because it reasons in the same figures that the customer does when considering investing in equipment to produce his own service. He is interested in the money required to put in his own plant—the demand charge. He is interested in keeping track of his production costs—the customer charge. He is interested in what the gas will cost per cubic foot—the consumption charge. It is fair to the customer less able financially to pay, it produces more satisfied customers by reducing high bill complaints, and it improves the company's position by removing the valleys and peaks in the net earning statement.

Gas in the Manufacture of Silk.—Gas plays an important part in the manufacture of silk. It is, says the "Gas Age-Record," used for steaming the cocoons so that the filament may be unwound; for boiling-off the silk to remove the natural gum and oil; for steaming the skein silk in order to remove any twist, enabling it to be wound on bobbins; in preparing the dyes; in conducting the chemical tests for dyes; for light in matching colour; for singeing the piece of silk; for the steam and drying chambers of the tentering machines, and for heating the steam rolls of the calender machine. The gas steam boiler is also used for heating the copper drums of the printing machine.

THE CONSTITUTION, ELECTION, AND TRAINING OF DIRECTORS.

By J. H. Brearley, M.Inst.C.E.

The Editor of the "Gas Journal" has dealt with "Gas Engineer" so much more ably than I could have done, that there is little left for me to say in regard to "Gas Engineer's" rejoinder in the issue of the 8th inst. We know now exactly where he stands. No long-service engineer or other administrator would be allowed by "Gas Engineer" to become a director of the concern to which he had devoted the long service, though he might be allowed, as a sort of compromise, to join the board of a concern with which he was less familiar.

And why? Simply because "A young and unknown man who has still to earn their confidence" would be "handicapped" in having on the board a man of wider experience. The contention is unconvincing, doing less than justice to the old and to the new. The old servant, after taking off the vestments of daily responsibility, would doubtless exercise a chastening influence upon schemes in which zeal might be prone to outrun discretion. In that way he would be a valuable asset to "a young and unknown man" who was treading a path in which he had yet to establish confidence and a reputation for expertness. The odds are that if the new man had tact and ability, he would find in the "old one" his greatest friend. Anyway, shareholders, when swopping horses, show their acumen if they keep the old one in the stable (board-room), instead of sending it to the knackers before they have seen that, indeed, the new steed is a fine one.

"Gas Engineer's" contention that "in very many cases the board meetings are hardly more than formal, as any important business is talked over and practically decided in individual meetings during the intervening periods," does not fit in with facts as I have found them in an experience of many companies.

There is no contradiction, as "Gas Engineer" seeks to establish, in what I said in the "Journal" of Sept. 17 last on the undesirability of gas engineers having to educate directors as a "duty," and my complaint that half the time of some engineers is taken up in educating gas committees. The latter referred to corporation, and not to company, undertakings. It is common knowledge that municipal undertakings would be more successful, and more enterprising, if the attention (usually considerable) which the controllers have to give to their committees could be diverted to business control, and if the said committees were as competent as company boards to discuss policy, and initiate such schemes as consumers' maintenance, for the uplifting of the undertaking.

Neither is there contradiction between myself and the Editor in our respective references to the "B.C.G.A." as an instructor of directors or committee-men. Obviously, the latter cannot attend "B.C.G.A." conferences and read the "B.C.G.A." literature without being considerably enlightened; the greater the degree of ignorance on gas matters, the greater will be their enlightenment. But it would be unwise to set it down as a specific duty of the "B.C.G.A." to educate, except as a natural outcome of activities devoted primarily to other ends. "Gas Engineer" spoke in his article of Sept. 3 as if the "B.C.G.A." should do something beyond what it is already doing. If that is not so, what object was there in invoking the aid of the "B.C.G.A.," when it is already doing to prudent limits what can be done to raise the standard of commercial and technical attainment in directors?

Finally, there seems nothing whatever to justify "Gas Engineer" in disfranchising gas engineers and other successful gas administrators from directorships, except a sneaking fear that they would display a special penchant for curbing the enthusiasm of a newly-appointed official when presenting schemes for the improvement of the concern of which he is put in charge. As if that attitude of mind would take precedence of the prime object of first seeking the well-being of the shareholders' interests which they have been elected to safeguard! Neither logic nor justice supports "Gas Engineer." Any new engineer who agrees with him betrays a lack of confidence in his own abilities to present an effective case for improvement that in itself is evidence of the unwisdom of having a board confined solely to individuals who have had no actual practice as administrators of gas undertakings. Let it be repeated that the ex-service man is not put on the board by shareholders as a "reward," but because the shareholders, recognizing his valued services, deem him the best man for the job. The shareholders are right.

Institution of Chemical Engineers.—The Council of the Institution met on the 8th inst., when some new members, graduates, and students were elected. Arrangements were discussed for entertaining the members of the American Institute of Chemical Engineers, who are to hold a joint annual meeting with the Institution of Chemical Engineers in England in July next year. The programme proposed extends from Sunday, July 5, to Wednesday, July 15, and embraces visits to Chester, the Lakes, Glasgow, Edinburgh, and Leeds (for the annual meeting of the Society of Chemical Engineers, if held at that time). It is proposed that the tour be made in cars, and an Organizing Committee has been formed to arrange details.

THE EQUIPMENT OF A LARGE COUNTRY HOUSE.

[Extract from a Lecture by Arthur H. Barker, B.Sc., B.A., Whit.Sch.]

Doom of the Open Coal Fire.—New Type of Gas-Fire Radiant Wanted.

There is one practical consideration in relation to domestic heating which, though it finds no place in current theory, is of great importance and must be attended to if real satisfaction is to be obtained. I refer to the necessity for the provision of something in the nature of an open fire in all inhabited living rooms. With all our improvements in modern labour-saving conceptions, we have never got rid—and probably never shall get rid—of the inherent liking of an Englishman for visible radiation. I strongly suspect, from what I have seen and heard of foreigners, that this peculiarity is by no means confined to people of the English race. The liking for a blaze or for some direct live heat—by which is meant high-temperature radiation—is, I believe, instinctive in the human race; and it is not a bit of use for heating engineers to try to circumvent it. Up to twenty years ago this requirement was always met by providing an open coal fire, the disadvantages of which device are too well known to need any mention here—the wasted labour, the sluggishness, the dirt and the dust, and the fouling of the outside air, and so on.

One of the principal practical requirements of a normal house in which there are busy people whose time is of value and who have not a great deal of leisure is, in my view, that it shall be possible at any hour of the day or night, winter or summer, to be provided instantaneously with some equivalent to or substitute—possibly an inferior substitute, but in any case a substitute—for an open fire. I regard this as an essential part of a satisfactory heating equipment of any house; and I do not know any method by which this can be supplied except by a gas fire (apart from electricity, which is too expensive). If a room is to be used all day as a sitting room, it is difficult to avoid the use of an open coal fire for its inherent comfort, in spite of its multitudinous and manifest drawbacks. That the gas fire will in time completely supersede the ordinary open coal fire, I have not the smallest doubt. The only thing that prevents that substitution from maturing at a very early date is the adhesion of makers of gas fires to the unsightly and inartistic type of fire which they have in their wisdom universally adopted up to the present. I refer, of course, to what I call the "skull and cross-bone" type of radiant, which gets almost white hot in a very few minutes, and thereafter gives an ugly, uninteresting, intense, and unsympathetic glare, which no sensitive or artistic person could possibly regard as the equivalent of an open coal fire. I have, in season and out of season, urged upon the makers of gas appliances to do some very solid thinking on this point. If any of them can produce one having something like the same efficiency of the present one, but having the sympathetic appearance of a coal fire, I believe he will make a very speedy fortune. I am equally sure the present form of gas fire will only hinder the development of the general use of gas, which is one of the most desirable developments for domestic heating that can possibly happen. I have tried to analyze what are the features in the well-known types of gas fire from which the mind of an artistic person recoils. I believe it is due to two things—that the wave length of the light which such a fire gives off is too small (*i.e.*, the light is not red enough), and secondly, the mathematical regularity of the design is exceedingly irritating, and the pattern is ugly. The heat given off from the radiant is too intense; it is painful for the eyes to look at the fire. If by accident one places one's legs within 2 or 3 ft. of it, they are apt to be scorched. The radiant efficiency is too great, the convection efficiency too low, so that the fire hardly operates at all in a convective sense. One ought to be able to switch it on or off at the door, as can be done with electric light. If these defects of the modern gas fire are obviated—as they certainly will, and must, be obviated—and if at the same time any improvements in the manufacture of gas enable its cost to be reduced, I fully believe that the days of the coal fire are very few. The outstanding advantage of the gas fire is that a busy man can come into a room, (say) his study, which will not perhaps be used again until the evening, for a quarter-of-an-hour after breakfast, to read his newspaper before he catches his train to the city, and be cosy and comfortable at once without waste of labour or of fuel. He would never think of putting a match to a coal fire, even if it were ready laid. This is a very great advantage; it is one without which any heating apparatus in a domestic establishment leaves much to be desired. One wishes to be able to use every room in the house, without the labour and expense of keeping the whole house warm enough to live in, throughout the whole of the 24 hours. The latter costs money, and is often useless. Further, it tends to make the place feel stuffy. Our central heating ought to air the place only, not to heat it, and heat it only when one wants it warm. Apart from electricity, which is too expensive for general use, gas is the only means we have which will enable this very desirable and great consideration to be secured. My own view is that the heating of a house is incomplete and defective unless every important room has a gas fire of attractive appearance, or at least the possibility of putting one in at short notice. There is no heating device yet invented equal in general utility in this climate to a well-designed gas fire, if such a thing exists.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

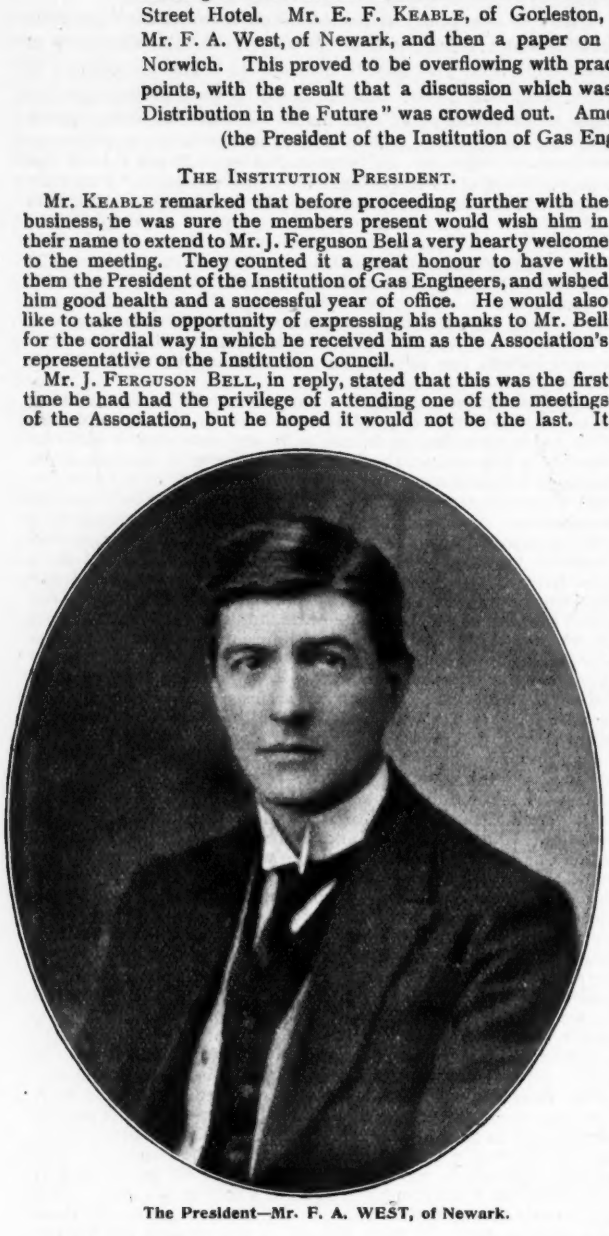
HALF-YEARLY MEETING IN LONDON.

The time at disposal proved not commensurate with the agenda that had been prepared for the half-yearly meeting of the Association, which was held on Wednesday last in the Abercorn Rooms of the Liverpool Street Hotel. Mr. E. F. Keable, of Gorleston, the retiring President, made way for his successor, Mr. F. A. West, of Newark, and then a paper on "Gas Purification" was read by Mr. R. A. Weston, of Norwich. This proved to be overflowing with practical matter of outstanding interest and with debatable points, with the result that a discussion which was to have been opened by the new President on "Gas Distribution in the Future" was crowded out. Among those present were Mr. J. Ferguson Bell, of Derby (the President of the Institution of Gas Engineers), and Mr. W. T. Dunn (the Secretary).

The Institution President.

Mr. Keable remarked that before proceeding further with the business, he was sure the members present would wish him in their name to extend to Mr. J. Ferguson Bell a very hearty welcome to the meeting. They counted it a great honour to have with them the President of the Institution of Gas Engineers, and wished him good health and a successful year of office. He would also like to take this opportunity of expressing his thanks to Mr. Bell for the cordial way in which he received him as the Association's representative on the Institution Council.

Mr. J. Ferguson Bell, in reply, stated that this was the first time he had had the privilege of attending one of the meetings of the Association, but he hoped it would not be the last. It



The President—Mr. F. A. WEST, of Newark.

was his intention during his year of office to visit the different District Associations, so that he might become more intimately acquainted with the members than he could hope to be by seeing them only at the Institution meetings. It was a great pleasure to attend a meeting of this kind, especially when he saw around him so many old and esteemed friends. The District Associations were doing work that it was not possible for the Institution to do; they met in various centres, and got to know one another's requirements. The Eastern Counties Association had done very good work in the past, and he was quite certain there was equally good work to be done in the future. He had just returned from Switzerland, where he was entertained by the Swiss Gas and Water Engineers at their annual conference. There coal had to be imported, and so the cost of gas was high. On the other hand, electricity was extremely cheap, because they had what they termed "white coal"—*i.e.*, water power. This water power they had developed in an extraordinary manner. He believed that in the course of a few years all the railways there would be electrified. But though electricity was in common use, especially for lighting, the gas undertakings were also making progress. They had not got back to pre-war conditions, but were very near them, and were getting substantial increases. For certain purposes electricity was sold at ½d. per unit, so that the competition was very great, but, as they said: There are uses for gas irrespective of electricity, and each has its sphere. In this country also there was a field for gas, and wherever he went he found an optimistic feeling that the gas industry was on the eve of greater prosperity and greater development even than it had experienced in the past.

Minutes of Last Meeting.

The minutes of the last meeting were taken as read, and confirmed.

New Members.

The Hon. Secretary (Mr. W. H. Mainwaring, of Lincoln) having notified the receipt of a number of apologies for absence, the following two new members were added to the Association roll, on the proposition of Mr. J. R. Bradshaw (Retford), seconded by Mr. C. G. Grimwood (Sudbury): Mr. Arthur W. E. Gregory, Gas-Works, Halesworth, Suffolk; and Mr. William Lister, Gas-Works, Fakenham, Norfolk.

The New President.

Mr. Keable said the time had now come for him to vacate the chair, but before doing so he would like to thank the members for their kindness to him during his year of office, and also the Committee and the Hon. Secretary for the valuable help he had received. All this co-operation enabled him to declare sincerely that his term of office had been exceedingly happy, and the year would be one of his treasured memories. He had tried all through to emphasize the importance of service, believing that true satisfaction and prosperity could only come along the line of ungrudging service. If the industry was to make the strides that were hoped for it, service would have to enter into every transaction. He wished for the Association and the industry the world over prosperity, and so long as he had strength he would strive towards this end. His next duty was to induct to the Chair the new President, Mr. F. A. West, for whom they all had the greatest respect and admiration. He had served the Association in many ways already, and all were aware of his abilities, both technical and commercial. He had on him the hall-mark of true sincerity, and his one aim was the uplifting of the industry.

The Past-President's Medal.

Mr. F. A. West (who was greeted with applause) thanked the members for the honour they had conferred upon him in electing him President, and Mr. Keable for his kind remarks. He would do his best to be worthy of them. His first duty was to present to Mr. Keable the Past-President's Medal, which he had pleasure in doing. He trusted it would serve to remind him of a very happy and successful year as President of the Association. He also wished to propose a very hearty vote of thanks to Mr. Keable for the services he had rendered the Association. It would be rather difficult to follow in his footsteps, for he had done well, and given of his very best.

Mr. J. W. Auchterlonie (Cambridge) seconded the proposition, with the remark that those who went to Gorleston had very pleasant recollections of the meeting there. Very much of the success of that meeting was due to Mr. Keable, and to Mr. P. D. Walmsley, who assisted him.

Mr. Keable, in acknowledgment, said he should regard the medal as the outward and visible sign of the members' feelings towards him. But much as he would prize the medal, he would prize still more the memory of the generous and kindly atmosphere with which the members had surrounded him during his year of office.

A Happy Thought.

Mr. Keable (continuing) said: There is one further matter, not on the agenda, with which I should like to deal. Arising out of a remark made by Mr. Canning when vacating the chair in my favour—*i.e.*, that the President retires from office just as he is getting used to it—and having since passed through a like experience, a remedy for some of the difficulties suggested itself to me. This leather case, which I designed, contains a skeleton outline of the duties and privileges of the office to which you, Mr. President, have now been called, as far as I have understood them. I feel sure the contents will save both yourself and our esteemed Secretary a considerable amount of correspondence, inquiry, and perhaps anxiety. May I respectfully ask you to accept this in the spirit in which it is offered, which is that it should be of service to you as a guide only. At the end of your year of office, I shall be glad if you will let me have the contents of the case, replacing them with your own matter for the benefit of Mr. Prentice, who is to succeed you; and thus from time to time I hope it will serve the purpose I have indicated.

The President said this suggestion and gift were only typical

of Mr. Keable's foresight and kindness. It was a good idea, and should prove of great value to newly-elected Presidents.

GAS PURIFICATION.

Mr. R. A. WESTON, of Norwich, then read a paper on this subject, which is reproduced, together with a report of the full discussion to which it gave rise, on p. 169.

Mr. W. W. TOWNSEND (Colchester), proposing a hearty vote of thanks to Mr. Weston, expressed appreciation of the work that had been done by him. It was a really fine piece of research work. They were greatly indebted in the Eastern District to Mr. Glover and his assistants for all they did for them.

Mr. P. D. WALMSLEY (Great Yarmouth) seconded, and added that when they were promised anything from Norwich they knew it would be something of super-excellence, and this always proved to be the case. He did not think the members from smaller works invariably appreciated what the larger works did for them in the way of research of this kind. Many undertakings were not of such magnitude that they could afford to pay for the expert assistance which the larger works could secure. In the Eastern Counties Mr. Glover and his Directors of the British Gas Light Company had set an example which might well be followed by some of the other big undertakings. He would like to associate with the vote of thanks to Mr. Weston, thanks to Mr. Glover for placing the necessary facilities at his disposal, and to the Directors of the Company for what they had done not only on this but on previous occasions. [Applause.]

PLACE OF NEXT MEETING.

The PRESIDENT extended a hearty invitation to visit Newark on the occasion of the next meeting.

After tea, the members separated.

"B.C.G.A." DISCUSSIONS.

At the Liverpool Conference of the British Commercial Gas Association, papers were read by Mr. R. E. Gibson, of Liverpool, on "Biscuit Baking by Gas," and by Mr. W. M. Mason, Manager of the "B.C.G.A.," on "Gas as an Aid to Health." The papers will be found on pp. 31 and 92 of the "JOURNAL," and we now supplement them by a report of the discussions to which they gave rise.

BISCUIT BAKING BY GAS.

Discussion.

The PRESIDENT (Alderman H. WADE DEACON, C.B.E., J.P.) having called for someone to open the discussion,

Mr. H. POOLEY (Leicester) said they were all very greatly indebted to Mr. Gibson for his paper on biscuit production at Messrs. Jacob's works at Aintree. The use of coal gas from a town supply was extremely interesting, because it had shown what so many of them had contended for so long—that the regular quality which they were able to give in town supply would, at moderate prices, beat any competition from producer or other gas. In Leicester there was an exceedingly interesting travelling oven heated by gas for the Co-operative Society, for the baking of bread; and this was put in after the most detailed investigation by the Society. The output was very great indeed, and the consumption most satisfactory. Mr. Gibson had referred to the various advantages to be obtained from the use of coal gas in connection with biscuit baking, but biscuit baking was only one branch of the baker's art. He (the speaker) ventured to say that the chief bakers of the country had already altered their methods of heating to town gas, and that those who had not done so would be compelled to do so in the future, to obtain higher efficiency at lower cost.

Councillor E. H. WRIGHT (Wallasey) thought they had not developed the type of gas oven which the small baker required. The ovens they had were all right for big factories, but for the smaller baker who used an oven (say) 8 ft. square, they did not seem to have got the right thing. If the engineers connected with the Association could develop something which would be really economical for the small man, it would be a benefit not only to the trade, but to humanity in general.

Mr. H. H. CREASEY (London) said the big biscuit manufacturers in London—such as Messrs. M'Vitie & Price, and M'Farlane, Lang, & Co.—used the type of oven that had been referred to in the paper, and there was no question that it was superior to anything else now available. The question of baking bread by gas was one to which they must pay great attention. Bread baking in a wholesale manner was a fairly simple proposition, because the oven was constructed specially for the purpose; but they had to provide for the baker who at present used a coke or coal heated oven, and who could not afford to turn out the oven and put in a completely new one. Some change in the internal arrangements had to be made. They had to convert an oven designed practically for an unlimited amount of heat into one using a much more uniform heat. They had been experimenting to get a furnace box designed for gas; and if they could succeed, gas would have a very fine chance, because there were many advantages in it over the use of solid fuel. They had converted one or two of the steam-tube type of furnace to gas. As an instance of the results obtained, he might say that they had turned out a batch of 199 2-lb. loaves for about 10d. With gas at (say) 9d. per therm, it would come out to about 2s. 1d. in the case of an oven originally intended for coke but converted for gas in the usual way. They had brought this down by experiment and adapting the furnace, and making it suitable at the start for gas, to 1s. 2d.; and that took them right into the field, because it saved labour. As regarded the small man, they were up against a very difficult problem—in fact, almost an impossible one. Very often the small man employed only one person, and more often than not he was by himself; and one could not tell him he was going to save labour by converting his oven to gas when the fuel cost was going to be £2 a week more. Moreover, the type of oven these small men used often belonged to the landlord, and had been built-in somewhere under the pavement, without room in which to instal a modern gas oven. They had either to convert the old one or do nothing at all. They were trying to find out the best method for converting the steam-tube type of oven, and he thought the "B.C.G.A." would shortly publish some information that would be a help in connection with this proposition.

Mr. F. C. BRIGGS (Dudley) thought there was a baker in Dudley now, quite a small man, who had believed it worth while to put in a small oven and change entirely to gas. He had saved a great deal in space and in foundations. He had been able to put the oven upstairs, where he had room, and it had not been necessary specially to strengthen the floor in any way. As far as the costs were concerned, he was very well satisfied, and was entirely pleased with the baking results. At the moment it seemed to him that there was a fairly big field for the small man who had room to extend upwards where he could not do so horizontally.

A DELEGATE remarked that he recently saw some bakers' ovens fitted for gas in Canada, and the firm in question—a very well-known one—were so pleased with them that they had decided to extend their use.

Mr. F. W. GOODENOUGH, proposing a very hearty vote of thanks to Mr. Gibson for his paper, said it would undoubtedly stimulate effort in the direction of the very important business to be got, not only with regard to the wholesale baking of biscuits—which, as has been truly said, they had practically captured now entirely, and of which there is a very fine example at Wembley in the biscuit baking section in the Palace of Industry—but it would turn their minds more than ever in the direction in which they should be turned—to solving the problem of the small man. There was a very large opening for gas consumption if they could find the right way of solving the small baker's problem. The point Mr. Gibson made in his paper, that when gas had been adopted for one purpose in an industry it very rapidly came into use for other purposes, was true of almost every factory in the country; and it was interesting to remember that the analysis by the British Commercial Gas Association of the use of gas in industry showed that, on the average, it was employed for seven different purposes in all the thousand-and-odd trades to which the President referred in his address. Their experience was that, once one got gas into a factory for one purpose, its advantages were so obvious that it rapidly became used for a dozen-and-one purposes.

Mr. R. HALKETT (Sheffield) seconded the motion, and congratulated Mr. Gibson on turning out producer gas and replacing it with coal gas. There was no doubt that they, in the industrial centres, had a competitor in producer gas, and they must be alive to that fact and keep in touch with their large consumers. In Sheffield they had always had a staff looking after the industrial side, but quite recently it had been found necessary to appoint a technical expert to go round to the large consumers and keep them posted up in figures relating to all fuels in connection with their particular work. An official like this had proved his value. Only the previous day he reported that two of the large consumers were thinking of adopting producer gas, but after going into the figures had immediately turned it down, and were now going to retain coal gas for all their uses. It would have been interesting if Mr. Gibson had given them the working costs of the oven referred to in the paper. Six or eight years ago he (Mr. Halkett) read a paper on gas for industrial purposes, and, if his memory served him right, he quoted the case of an oven 50 ft. by 4 ft. 6 in. wide, which was turning out, in a nine-hour day, 1¼ tons of biscuits, or 11,000 per hour, with a consumption of 850 c.ft. of gas, at 2s. 1d. per 1000 c.ft. This worked out at that time at 1s. 10d. per 11,000 biscuits, which was very economical. Messrs. M'Farlane, Lang, & Co., and the Co-operative Society in Glasgow had each installed one of these ovens, and on the figures obtained they were putting in second ones, which showed that they were very well satisfied.

Mr. GIBSON, in replying, said Mr. Pooley had referred to the use of gas for bread baking. In Liverpool it was employed for this purpose to a considerable extent. When considering these problems, one had to remember the very great number of other advantages, apart from the mere cost of gas. The furnaces should be specially designed for the use of gas, otherwise the best efficiency and the greatest economy could not be obtained.

Mr. J. W. M'LUSKY (Glasgow) said Mr. Halkett had referred to a test made in Glasgow some years ago which was very successful in that particular factory. It was so successful that a new factory had been completed with nine 55-ft. ovens, all making biscuits with gas. The total consumption was about 25 million c.ft. per annum. There would be no solid fuel at all in this new factory, gas being used for heating, and electricity for power and lighting. The output would be 30,000 boxes of biscuits a week.

GAS AS AN AID TO HEALTH.

Discussion.

Mr. J. W. M'LUSKY (Glasgow) said the only way to create a better feeling and to dissipate prejudice was to know their public. Mr. Mason had mentioned that they ought to go out for 100 p.ct. efficiency. They were working in this direction. The more one learned about one's own locality, the more one saw how much required to be done. It was their business to follow the results right up to the finish, and see that

every appliance was using gas efficiently. They should keep in touch with the public, know what the public want, and see that they got it.

Mr. H. M. Thornton said he knew, speaking as a manufacturer, that they had not yet scratched the surface of the field for gas fires. It would perhaps astonish a great many present to know that, even to-day, after 26 years of work in this direction, they were sending out more gas cookers than gas fires. Many might ask, "Is there anything strange about that?" He thought there was, because they had only the possibility, as a rule, of one cooker in a house, whereas there was the possibility, as far as gas fires were concerned, of having six or even more. This brought him to the point he wished to make. In the old days—they called them old days, though they looked back on them with a good deal of pride and pleasure—a great campaign went through the country for the gas cooker. There were exhibitions, canvassing, and, in fact, everything that could possibly be done, to bring before the country the advantages of gas cookers. The gas fire had certainly not had the same educational advantages. It might still be in their minds that it was not necessary to do the same thing in regard to gas fires, but he did think they were rather forgetting the advantages of the simple-hire system for the gas fire. They were pressing direct sales and hire-purchase. These were both good in themselves, but he believed one of the great reasons for the success of the gas cooker was the simple-hire practice adopted twenty years ago. There were difficulties and dangers in the simple-hire system, but it was worth consideration to a greater extent than it received to-day. He knew that the Chairman of the Executive of the "B.C.G.A."—not in that capacity, but representing the largest Gas Company in the world—would confirm what he (the speaker) was trying to convey with regard to the desirability of the simple hiring of gas fires. In fact, he thought he would not be exposing anything he should not when he said that their purchases of gas fires were largely due to the simple-hire system and the educational policy they had adopted, and the fires placed in this way were not far short of 35 p.ct. of the whole. If simple hire was not practicable with many, he would urge the extension of the hire-purchase system beyond the three years often practised. After the establishment of a gas fire or any piece of apparatus in a house, the maintenance of it was just as essential as the starting of a simple hire or any other system. Gas fires ought to be inspected at least four times a year. What Mr. Mason had said of hospitals was quite true. He had occasion, unfortunately from the health point of view, to be in St. Thomas's Hospital for two or three days. He was able to get about, and made the best use of his time in discussing with the doctors, nurses, and sisters, and even patients, what they thought of the gas fires and other gas apparatus used in the hospital. There was not one word of prejudice. All praised the wonderful installation, and he was sure the educational value of this one hospital equipment must have been immense.

Mr. F. W. Goodenough wished to make it quite clear that the object of the paper, and of any of the facts given in it, was not to draw attention to, or glorify in any way, the Company with which he was connected. They all of them, in their particular districts, had got the opportunity which every gas undertaking in the world had, and if they did not make the best use of it, they would fail in their duty to their undertaking and to the industry as a whole. Therefore the only reason for bringing before the industry the facts that had been put together was because they were of the very greatest encouragement to everyone, as showing what could be done among the higher ranks of physicians and surgeons of the country. This had, of course, a reflex action throughout the medical profession. There was not the slightest suggestion intended in the paper that any other gas undertaking, with the same opportunity, would not have made equal use of it. With regard to the question of simple hire, owing to the difficulties of the war the Gas Light and Coke Company suspended the facilities for simple hire because they could not get more appliances than they could sell. In September three years ago, however, the Board of Directors decided that the time had come to resume simple hire. The net increase in gas appliances supplied to ordinary consumers—excluding slot meter customers—during the twelve months that ended with the September in which that decision was arrived at (of course, he meant the stoves sent out, deducting those brought back from hire owing to the consumers leaving the district or changing, *plus* the actual sales for cash and on hire purchase) was approximately 22,000 new appliances. The net increase in the twelve months following the resolution to revert to simple hire was between 44,000 and 45,000, while in the next twelve months the figures were almost identically the same—45,000. For the twelve months ended the middle of September this year, the increase had been 12,000 above the record, or 56,000 in all—far and away the largest increase the Company had ever had, comparing with the largest pre-war increase of 37,000 in any twelve months. These figures spoke for themselves as to the advantage of resuming simple hire three years ago. He was strongly of opinion that the hire of gas fires had an advantage, because if a consumer had a doubt about whether they were going to be satisfactory he would not buy, but he was willing, if they would take the risk of letting out on hire and having the appliance returned if he were not satisfied, to risk the cost of fixing. As Mr. Thornton had said, it was not only a question of one or two gas fires. The largest number that he remembered going to a private house in his Company's district was 28. They could get from one to close on thirty gas fires in individual houses, if they provided the facilities. Then afterwards they could sell them from hire, if the consumer was satisfied. His Company had fitted for doctors and architects, under their scheme, over 10,000 fires, and had never had to take one out through the dissatisfaction of the consumer. There was nothing more important for them to do at the present time than to emphasize to the public the possible advantages, from the point of view of health, of gas.

The "Bulletin" of the St. Louis Public Library for August-September contains a study of police power in connection with smoke abatement, as embodied in laws, ordinances, and court decisions. It is a full statement by Mr. Lucius H. Cannon, Librarian, Municipal Reference Library, and the price is 50c., postage extra.

THE UTILIZATION OF REFUSE FUELS.

A Striking Example from France.

It will be agreed that any comprehensive national scheme of fuel economy must include the efficient burning of all refuse fuels, coke breeze from gas-works and coke ovens, and the low-grade material from collieries. It is in this latter direction, however, that most opportunities occur; and if the colliery industry would adopt more scientific methods, it would certainly be able, for the same costs of production, to release a very large amount of saleable coal, and be in a position to give both a cheaper and a better product.

What may be accomplished in the way of utilizing refuse coal at the pit-head is strikingly illustrated by developments now taking place in France at the Mines Dominales Françaises du Bassin de la Sarre, which cover an immense area of ground to the south-east of Metz, being one of the largest groups of mines in Europe. By the treaty of Versailles, this has been ceded to France by Germany for fifteen years, and the French engineers in charge, in accordance with their national policy of fuel economy, have determined to utilize for steam generation the vast amounts of refuse fuel—estimated at something like 1,250,000 tons—that have accumulated at the pit-heads, so as to release from the boiler plant the equivalent of good-quality coal.

As a result of detailed and systematic investigations into the problem of burning this material in steam boilers, mostly of the cylindrical type, in which all kinds of different appliances were tried on the large scale, they placed orders for nine "Turbine" forced-draught steam-jet furnaces. The results obtained with this equipment have proved to be so satisfactory that an order has now been placed for the equipping of 89 boilers—probably the largest single order for forced-draught equipment that has ever been placed in the world. The "Turbine" furnace is, of course, a British production, well known to gas engineers because of the facility with which it will burn coke breeze. It is the invention of Mr. V. R. Chadwick, who is a Director of the Turbine Furnace Company, Limited, of London, and the business on the Continent is now controlled by the Cie. Continentale des Foyers Turbine, whose head offices are at No. 29, Rue de l'Evèque, Brussels, and the Compagnie Française des Foyers Turbine, No. 24, Rue Caumartin, Paris. A separate company has also recently been founded in Australia.

It will be remembered that the essential features of the "Turbine" furnace are the methods of distributing the forced-draught blast evenly to every portion of the grate surface, both transversely and longitudinally, combined with the fact that the total air supply to a standard 6 ft. by 3 ft. grate surface—for example, as in the case of "Lancashire" boilers—contains over 2000 separate air slots, so that fine material, such as coke breeze or coal dust, cannot fall between the bars, while, of course, ordinary coal or coke can be burnt without difficulty, and the steam consumption of the nozzles does not exceed 3 p.ct. of the water evaporated in the boilers.

Peat Fuel in Sweden.

Peat exists in great quantities throughout Sweden, and the annual pre-war production of peat fuel for industrial use amounted to from 50,000 to 75,000 tons, which quantities were largely exceeded during the war. Generally speaking, the industrial uses of this fuel are for boiler firing in stationary plants or in railway locomotives. In the iron industry it is sometimes employed in gas producers; but, according to Mr. Axel F. Enström, Director of the Royal Institute of Scientific and Industrial Research, its regular distillation in retorts in connection with the utilization of bye-products has so far only been tried on an experimental scale. Much work has been devoted in Sweden to experiments on the production of a refined peat fuel, but without any economic success. Wet carbonizing was tried, among other methods, by de Laval, and a big plant was built. The only practically successful proposition has been that of producing pulverized peat, which has been used for several years as a locomotive fuel in some districts of the country. The air-dried peat is ground to an extremely fine dust, and, after that, again dried artificially to a moisture content of only 12 to 15 p.ct. The powder is stoked automatically, and has proved advantageous in locomotive service. Careful precautions must, of course, be taken to save the fire-box from burning out.

Influence of Catalysts on Carbonization.—Dr. R. Lessing and Mr. A. L. Banks will present a paper on "The Influence of Catalysts on Carbonization" to the Chemical Society to-morrow (Oct. 16). The meeting will be held at 8 o'clock, in Burlington House, Piccadilly.

Scottish Junior Gas Association.—The opening meeting of the twenty-first session will be held in Windsor House, Hillside Crescent, London Road, Edinburgh, on Saturday, Oct. 18, at 2.30 p.m. Mr. W. R. Herring, M.Inst.C.E., will deliver an address, in which he will review the salient points dominating the gas industry during the life of the Association. At the conclusion of the meeting a dinner and social evening will be held to celebrate the twenty-first birthday of the Association.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

AUTUMN MEETING AT SOUTH BANK.

The Autumn Meeting of the Association was held at South Bank, near Middlesbrough, on Friday, Oct. 10—Mr. S. Shadbolt (the President) in the chair. There was a large attendance.

On the motion of the President, members passed a vote of sympathy with Mr. Herbert Lees, of Hexham, the only and deeply respected Hon. Member of the Association, in the recent loss he had sustained by the death of his wife.

Among the apologies for absence was one from Mr. J. Ferguson Bell, President of the Institution of Gas Engineers.

The President said there had not been a meeting of the Committee, but he felt that the following new members would be approved:

C. F. Barrell (Sunderland)—Member.
D. Lockey (Spennymoor)—Associate Member.

Mr. Shadbolt then delivered his

PRESIDENTIAL ADDRESS.

Gentlemen,—Permit me at the outset to take this opportunity of acknowledging the honour you have conferred upon me in electing me as your President, and of expressing the hope that my year of office may not involve any regrets. I am pleased to-day to be able to welcome you, as an Association, to the district of my own undertaking, and to assure you of the satisfaction it is to my Directors to be able to offer you entertainment.

The PRESIDENT, Mr. S. SHADBOLT,

Engineer and Manager of the South Bank and Normanby Gas Light and Coke Company, Ltd.

The President is a son of the late Mr. R. Shadbolt, of Fleetwood, and younger brother of Mr. R. G. Shadbolt, of Birmingham. He received his early training and education at Fleetwood, and has been in active management of gas-works since 1902. He succeeded his father (after his death in December, 1909) at Fleetwood as Engineer, Manager, and Secretary; and he took his present appointment in November, 1915.

The undertaking I serve was formed in May, 1866, and is thus a little over 58 years old. We have obviously no claim to antiquity; neither have we anything sensational in the way of elaborate plant or novel processes to display. I hope, however, that an examination of our works will be of interest to you, particularly as an instance of a plant largely reconstructed and extended, under the difficult conditions imposed by the war and after. Since the outbreak of the war, our output has increased, our works have been remodelled, and our distribution methods have been largely amended, so that we have to-day a good margin above present maximum demands, on all plant up to the purifiers, whereas ten years ago all the corresponding apparatus was considerably overtaxed. With approximately 58 p.ct. increase in volumetric output, this has been accomplished without taking our capital expended to a higher figure per million than it was in 1914 (about £530).

This has only been possible by the careful selection and use of second-hand plant; and in this particular I venture to hope that the results will convince any who may doubt the wisdom of second-hand purchases (as I myself most certainly did at one time) that much may be done in this direction without any misgivings, if proper care be exercised when making purchases, and effective attention paid to re-conditioning during re-erection. The water-tube condensers, the bigger of the two exhauster sets (80,000 c.ft. per hour capacity), the Holmes rotary brush washer, together with all connections from the inlet of the condensers to the inlet of the purifiers (with the exception only of a few necessary special pipe castings), have been arranged and erected from second-hand purchases, and can deal with a one million c.ft. a day throughput (our maximum day so far has been under 700,000). Other second-hand items in use include a pair of Babcock & Wilcox steam boilers, and steel chimney, practically all the steam pumps throughout the works, the power units for the two boosters, and the little vertical engine driving the compressor for the atomizing apparatus described later. The weighbridge for rail traffic in and out of the works was also good, cheap, and second-hand; and the national coal stoppage in 1921 (though "ill wind" enough) gave the opportunity to instal this on our single-line siding without hindrance to traffic. Even ex-army huts have proved useful, though they are certainly not ornamental.

CARBONIZING PLANT.

Ten years ago, the carbonizing plant consisted of stop-ended horizontal retorts entirely, operated by a manual charging machine (of the Biggs Wall type). The one retort-house contained three benches, all on one front, of regenerative settings, 11 beds providing in all 78 retorts. In 1914, the Board placed an order with Messrs. Drakes for a new retort-house with four through beds of six retorts each, 24 in. by 16 in. by 20 ft. long, ⏀ section, complete with coal handling plant and stoking machinery of the firm's well-known type. The outfit included gas-engine driven dynamos in duplicate, of 20 kw. capacity each. Of a nominal day's capacity of 500,000 c.ft. output, the plant was laid out in preparation for future extensions.

On my appointment here (late 1915), I had only the old manual worked house with which to get through the peak of the first winter; the new house, being a little delayed in completion owing to the war, actually coming into operation in the spring of 1916. Since then the rapid increase in our gas output has been catered for, with economy in capital outlay, by the installation of a Tully plant in 1920, and a second somewhat larger unit of the same make in 1923. These plants are used for the gasification of coal only (the total gasification of coal is such an ambiguous phrase that I do not care to use it), and represent the only works plant bought new since 1915. Even in this matter we took the opportunity to save a little in cost (when installing the second plant), and to gain considerably in strength, by the purchase and use of an old boiler of $\frac{9}{16}$ in. plate throughout, for the provision of the generator shell.

To-day, therefore, our generating plant consists of—

Machine-stoked horizontal retorts of a nominal output of				500,000 c.ft.
One Tully gasification plant	,,	,,	,,	300,000 c.ft.
,, ,, ,, ,,	,,	,,	,,	400,000 c.ft.

Allowing for the difference between nominal and maintainable efficiencies, this plant could produce a million c.ft. of 400 B.Th.U. gas per day. Under emergency conditions, the old retort-house can still be put to use up to a quarter of a million a day, and contains an experimental gas producer of our own construction capable of producing a low-quality diluent gas, should circumstances make this necessary.

PURIFICATION PLANT.

Condensers, exhausters, two Livesey washers in series, and a Holmes brush washer follow on the retort-house; and, as already stated, are capable of dealing with a daily throughput of one million c.ft. We have a set of four purifiers, built in the open, each 20 ft. square by 5 ft. deep, fitted with luteless lids and 18 in. Weck valve and connections. During the last year or so, we have altered these boxes ourselves to secure the gas flowing through each box from the top downwards, with improved results; but it is still obvious that, as soon as any healthy stimulus to increased output again occurs, the question of increased capacity here will need to be faced. While dealing with purification plant, the narration of our difficulties with a leaky Weck valve may be sufficiently interesting to justify its inclusion.

The present purifiers were installed in 1893, and unfortunately an explosion, soon after their coming into use, caused a certain amount of damage, the obvious part of which was immediately repaired. On taking charge of the works, I was told that there was a little difficulty with gas escaping when a particular box was off for cleaning and refilling, and that this had been getting more pronounced for some years. As this became very objectionable and risky, I tried a thorough cleaning of the valve surfaces, only to find the effect aggravated. About the late summer of 1918 we got to such a point that, to change the material of the box most

affected, we actually had to stop the gas make and shut off the holder inlet to prevent loss of gas. Most of you will recollect the stress of circumstances in those days sufficiently to realize the difficulty; and under these conditions I adopted a course which I sincerely hope I shall never be called upon to follow again. I fell back upon the expedient of inserting an 18-in. Goodman main stopper between the Weck valve and the box itself (fortunately there was just room for this) on each of the connections, before opening a box. The risk of this proceeding, with the pressures inevitable and the fact that the insertions had always to be made in a pit with a tightly boarded top, was distinctly heavy, and indeed we had one or two unpleasant incidents. Ultimately, one valve disc fell away from its spindle within the valve during the winter of 1920-21. In 1921 we picked our opportunity during the minimum load period, and with one skilled man from the valve makers and the co-operation of a local engineering shop we renewed all eight valve spindle ends, inserted two new discs, and refaced and refitted all the rest, at the same time discovering and repairing a crack in the interior of the valve obviously caused at the time of the explosion—stopping the gas make on three occasions, and in all refacing thirty-two 18-in. valve faces within the space of one working week. I believe this is somewhere in the neighbourhood of a record. It certainly took a little organizing, but it was completely successful; and I should at any time be happy to go into details with any brother engineer who might have an interest in a similar task. Incidentally, special labour and material cost only £70 for the complete repair.

STORAGE.

Gasholders provide storage for 700,000 c.ft. in two holders, of 500,000 c.ft. and 200,000 c.ft. capacity each. The larger of the two is a spiral-guided 3-lift in a 100 ft. dia. steel tank above ground-level, and is used for the town supply; the smaller holder, a 2-lift frame-guided one in brick and puddle tank, is used for the storage of the diluent gas from the Tully plants.

OTHER WORKS IMPROVEMENTS.

Other works improvements include the establishment of a laboratory, thus securing constant check and record of gas compositions, and the basis generally for chemical control of our operations, together with the usual tests for residuals, and the opportunity for such chemical examinations and investigations as occasion demands from time to time. The subsidiary works buildings have been largely altered, to ensure provision for distribution stores, motor garage and workshop, works stores, fitters'

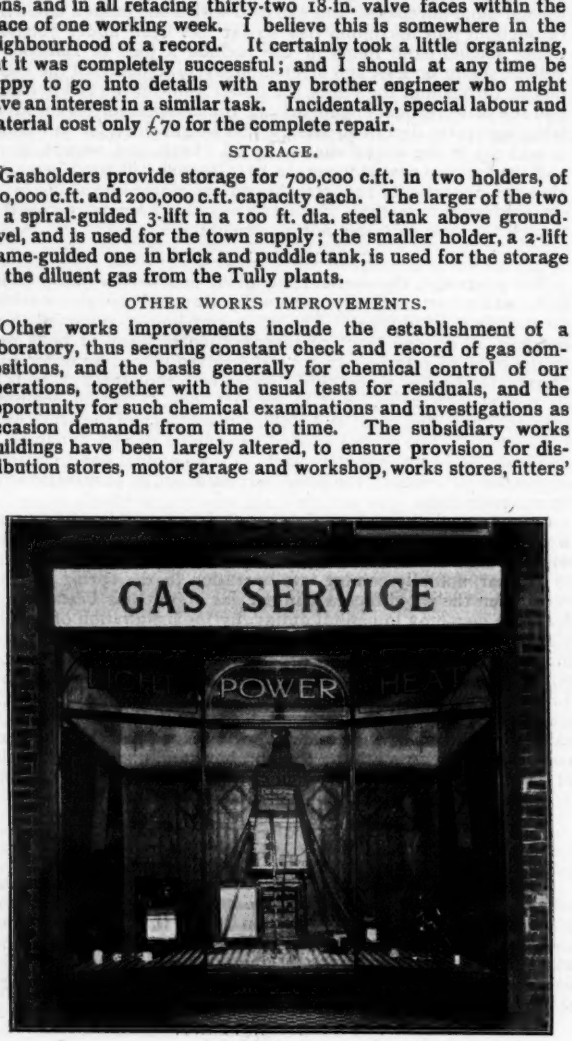


Fig. 1.—Show Window.

accommodation and institute room, while a small but effective show window (unfortunately very difficult to photograph) of our own design, and of very modest cost, has been built into the wall of the old fitting shop, so giving a display window on one of our principal roads. It coincides with a tram stopping place and provides a good position.

From the gasholder outlet, the most interesting additions in the way of apparatus are the provision of boosting fans in duplicate, the alteration of the district governors to withstand the higher inlet pressures, and the installation of atomizing sprays (operating on the governor outlets) injecting naphthalene solvent into the gas as it leaves the works, as described later.

Meter repair work in our own hands has proved a distinct advantage. In this we are fortunate; for without a doubt the entire dependence on one man for this work in small undertakings is unavoidable, and I can readily conceive circumstances in which this type of activity might be of little help.

In the district, much has been done towards eliminating unsatisfactory mains and services, and a good deal is still to be done. The prevailing fashion of providing work in the winter time, by local authorities undertaking street repairs on a big scale, caused our undertaking, among others, to spend a great deal above normal during the last winter on repairs and renewal of mains, &c. This is a contingency which appears to be inseparable from present-day conditions, as is also the liability to main and service alterations to meet the exigencies of reinforced concrete road making. Anything which improves the distribution system is of course ultimately of some benefit, but it is always possible that a beneficial condition may cost more than its value, and in any case it appears that temporary borrowings and suspense accounts will probably be necessary in many cases to meet the desires of road authorities, and safeguard the mains of the gas undertaking at the same time. In face of the inconvenience which our various undertakings suffer already in this manner (undertakings owned by local authorities may in this respect be better placed than companies), it is most desirable that no such powers as are being suggested to enable road authorities to demand main alterations at the cost of a gas undertaking, to suit their road alteration schemes, should be granted. Sufficient expense is already unavoidable to secure inspection and maintenance during the frequent street repairs under existing conditions.

GAS SALES.

In the matter of gas sales, our undertaking, serving as it does a largely industrial population, has for some years sold the greater portion of its gas through the medium of the prepayment meter. Gas sold to private consumers during the last financial year (1923) showed that 66 p.ct. was through slot meters. In these circumstances a good deal of attention has been paid to the fostering of this branch of our business; and we are now trying the experiment of fixing a limited number of gas wash-boilers as part of the prepayment installation. If the experience gained warrants it, we shall doubtless make this a permanent feature. At present we have 3 classes of slot consumer: *Class A*.—Consumers having prepayment meters only, fitted by ourselves, supplying gas through the consumers' own fittings. *Class B*.—Consumers whose installation provided by the Company includes two lighting points and a boiling ring; and *Class C*.—Consumers whose provided installation includes a gas cooker. In addition, *Class D* (at present experimental) covers Class C installations, *plus* a gas wash-boiler. The difference in the rentals for the varied classes is arranged by the discounts returnable; and the amount so charged above the ordinary rate for gas is graded as follows: Class A., 1·8d.; Class B., 2·2d.; Class C., 3·0d.; and Class D., 3·8d. per therm.

GAS QUALITIES.

Realizing that some interest may centre round the quality of gas supplied by my undertaking (our declared calorific value is 400 B.Th.U.), I have extracted figures from our recorded tests, going back twelve months from June 30. Tests of the gas sent out are taken every working day, and also of the diluent gas produced in the Tully plants (these tests are taken from the relief holder). The coal gas coming off direct from the retorts is sampled and tested separately on special occasions. The hot gases are mixed by admitting a regulated stream of the diluent gas to the foul main immediately the coal gas leaves the retort-house governor. Exhauster pull and valve regulation on the diluent gas main together provide a very effective control of the volume of diluent gas going forward.

A fair example of the percentage composition of the coal gas from the retorts is as follows:

CO_2.	O_2.	CO.	C_nH_m.	CH_4.	H_2.	N_2.	Cal. Val.
1·8	0·4	5·6	2·0	24·0	59·0	7·2	501 B.Th.U.

The composition of the gas supplied to the town, as revealed by the average of all tests taken during the four quarters of the year referred to, works out as follows:

—	CO_2.	O_2.	CO.	C_nH_m.	CH_4.	H_2.	N_2.	Cal. Val.
								B.Th U.
Sept. quarter, 1923	6·4	0·9	10·8	1·2	23·5	50·0	7·2	400
Dec. ,, 1923	4·6	0·9	9·3	1·3	23·1	50·9	9·9	403
March ,, 1924	6·0	0·7	16·6	1·2	15·6	53·3	6·6	406
June ,, 1924	7·0	0·7	21·0	0·9	13·3	53·1	4·0	400

The variation in the diluent gas inevitable during the winter owing to the load factor and the difficulties of working prior to the completion of the second Tully plant, is reflected in the composition shown, particularly in CO and CH_4 content (the condition of the old plant, owing to a corroded shell, was very bad indeed just prior to its recent overhaul).

The recent report to the Board of Trade by Mr. W. J. A. Butterfield, with the correspondence thereon, is a most interesting publication; and however one views the differences arising as between the report and the official rejoinder of our industry, we must all feel a sense of satisfaction that the defence of unrestricted composition, with especial regard to CO content and toxic properties, has been so completely vindicated by such a searching and capable scrutiny as this report represents.

In considering the average of our mixed gas analyses as shown, it has been interesting to calculate over the periods covered, from the known volumetric makes, the theoretical CO content according to the very useful formula given by Mr. Butterfield in his

report. To illustrate this, I have set out the results with the inerts, divided and in total, for the quarterly, half-yearly, and yearly figures, in the following manner:

Period.	CO Content by Tests.	CO Content by Butterfield Formula.	N_2 and O_2 Content.	Total Inert Content.
	P.Ct.	P.Ct.	P.Ct.	P.Ct.
Sept. quarter, 1923 .	10·8	14·4	8·1	14·5
Dec. ,, 1923 .	9·3	14·49	10·8	15·4
March ,, 1924 .	16·6	17·40	7·3	13·3
June ,, 1924 .	21·0	20·24	4·7	11·7
Half-Year, 1923 . .	10·0	14·43	9·4	14·9
,, ,, 1924 . .	18·8	18·52	6·0	12·5
Full Year	14·4	16·39	7·7	13·7

Comparison of these figures shows a diminishing discrepancy as the year proceeds. This is accounted for by the fact (already mentioned) that for the first half of the year we were dependent upon a Tully plant, the shell of which was corroding badly, with the inevitable result that our diluent gas was not up to normal either in quality or quantity.

Shortly after the end of the second quarter, we brought into use (new) the second and larger unit of this plant, with the consequent provision of an improved and more plentiful diluent. The effect is plainly visible in the varying difference between the recorded average tests and the Butterfield calculations of CO. The figures showing the test results in N_2 and O_2 inerts, and also total inerts, further illustrate the result of using this formula where, for any reason at all, dilution of straight coal gas with any diluent other than true water gas has occurred; for, of course, when our Tully plant was not sufficient for our needs, other and more informal measures had to be adopted to keep to the declared value.

HIGH AND LOW CALORIFIC STANDARDS.

As regards calorific standards generally, a big sphere for reasonable thinking and deduction exists, apparently little trespassed upon by many of our professional publicists. Many who tenaciously favour the higher calorific standards persist in standing immovably on the assertion that one therm is as good as another in any and all circumstances, no more and no less, and the less its bulk the better it is to supply. On the other hand, extreme champions of low standards are prone to deride the idea of any possible efficiency with gas of higher standards than their own.

Often an extreme illustration is effective; and if we contemplate the use of a good type of boiling burner with two distinct types of gas—say, one of 600 B.Th.U. and one of 200 B.Th.U.—it is surely obvious that in one case wasted heat units will be easily realized, while in the other they would be very unlikely indeed. If those who profess to see no use for anything which they consider "low grade" would admit that high qualities may facilitate wastage in use, and low qualities tend to avoid such waste, a good point would be gained; and if the champions of very low grades would acknowledge that their particular conditions governing policy may not apply in all cases, and indulge a little less in the unconvincing assertions that quality variations do not matter at all, a lot of useless discussion might be cut out.

Three years ago (in my contribution after the coal strike), I stated that, considering the need for economy in capital expenditure, following the ideal of coal conservation, and believing that lower-grade gas than we had been used to would offer the biggest possibilities, I had experimented and, after trying lower grades, had decided on 400 B.Th.U. as the most suitable standard for my own district. I explained that nearly all our gas was sold for domestic or similar use, and that consideration of flat flames was not necessary (one cannot help regretting that this extravagant lighting medium should need considering anywhere). Therefore I may briefly state our position as follows: We believe in treating our coal for gas making as far as we usefully can, and find that a 400 B.Th.U. standard permits this, having regard to the nature of our demand, the use of standard types of consumers' appliances, and our distribution facilities. Therefore our first task is to follow the best means of economical production of that quality, as circumstances vary, rather than to hasten to change the declared standard with fluctuations of residual values, &c. Further, we have satisfied ourselves, by closely observing results, that consistency of supply as to pressure and composition of gas is vital in the satisfactory performance of gas in everyday use, and an ideal well worth striving for. In this regard, I am convinced that the inert content of gas supplied is much more to be feared when widely varying from time to time, than for any inherent disadvantage attached to inerts as such. For this reason I agree with those who disapprove of the regular dilution of straight coal gas with anything other than a properly-made diluent gas of lower quality. Intermittent overpulling, and widely varying diluents generally, in so far as they involve inconsistent composition and result, are to be deplored and avoided. We are aiming at being able largely to stabilize our retort-house and Tully-plant gas, both as to composition and proportion, as an ideal method of producing a 400 B.Th.U. mixed gas. Linked up with the proposition of supplying any grade of gas is the ability to give the pressures required; and it is, of course, a different matter in these days from what it was when we had only flat-flame lighting, or even upright incandescent. Here the experience we have gained since adopting the very simple and rapidly increasing practice of boosting up to the governor inlets, permits the unqualified recommendation of this method of securing constant control of pressures at the works outlet, particularly where telescopic gasholders make big variations in their outlet pressures.

NAPHTHALENE.

A few notes on our experiences with naphthalene may be interesting. One of our principal sources of trouble in this direction, when I first came to South Bank, was the deposition of naphthalene in our works connections, particularly in the main from the scrubbers to the purifiers. At that time this main was overtaxed (having about 50 yards of 12-in. pipe in its course), very shallow as regards cover, and for a considerable length

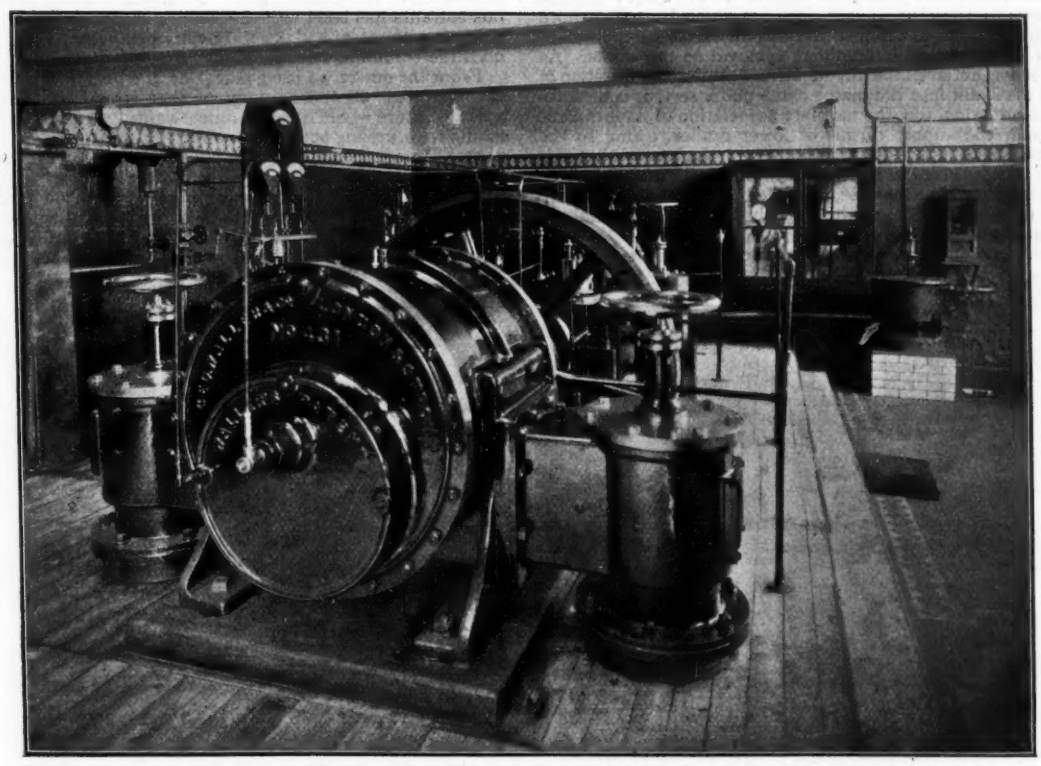


FIG. 2.—EXHAUSTERS, SHOWING PARAFFIN VAPORIZERS AND GAS QUALITY INDICATORS.

practically without any fall. To deal with this trouble, a paraffin vaporizer of the gas-heated type (seen in fig. 2) was installed. We found that by sending a stream of vapour-charged gas into the last scrubber outlet the pipes were gradually cleared; the condensation bringing out the naphthalene in solution. Within a month we had this particular trouble well in hand. From our experience we found no such interference with the oxide in the purifiers as some have predicted would follow this method. Apart from keeping free from interference with works operations by naphthalene, I found that the winter-time experience in the district was a very unsatisfactory record of naphthalene troubles; and from the first this question had my attention.

The operation of the vaporizer on the works was so effective that I considered a similar treatment for my outlet main; but the complete manner in which the vaporized oil came down in a comparatively short length of main, turned my attention to the alternative of treatment which would not depend on artificially created temperatures to carry the solvent—besides which I also felt more attracted by the theories either of carrying forward the naphthalene content to the burner, or of complete removal on the works. As works plant was not available for effective washing, the question of atomizing a solvent into the mains came under serious consideration. Remembering, too, the intimate association of naphthalene deposits with the supply of gas of lower grades, owing to the reduced content of heavy hydrocarbons, and the theory that this dryness of the gas gives that condition which facilitates corrosive action in the mains and services, I decided to experiment with the atomizing method of dealing with naphthalene on the district, as against vaporizing on my outlet mains.

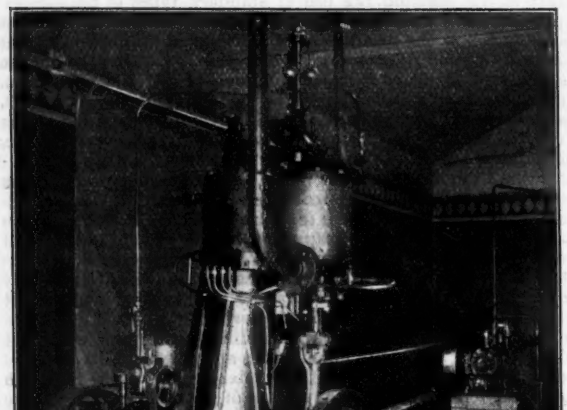


Fig. 3.—Engine and Compressor for Atomizing Plant.

The results of our first winter's experiments were such as to warrant further treatment; and the installation as seen to-day is the outcome, and has been operating as at present for the last twelve months or so.

Fig. 3 shows the arrangement of the engine and compressor. The little engine was taken from a submarine chaser, and had driven a centrifugal pump. The pump was taken off, and a belt pulley put on. The drive is easy, and the power ample. The compressor pumps gas from the outlet main of the holders, just before the governors, and delivers into two cylindrical receivers, coupled and fitted with pressure gauge and safety valve, which are kept up to a pressure of 50 lbs. per sq. in. (These receivers, by the way, were very simply made from furnace tubes taken from the boiler which provided the shell for the last Tully plant.) Each receiver measures inside 2 ft. diameter by 14 ft. 9 in. long; and the two receivers permit of a two hours' stand of the compressor for cleaning or minor adjustments before putting the atomizers out of effective action. The high-pressure gas works three separate atomizers—one on the outlet of each of the district governors—of the Aerograph Company's pattern, each supplied with solvent through a sight feed conveniently placed near the governor-house window, from a tank kept outside the building, and sufficiently elevated to provide a gravity flow. We have had three winters during which this method has been more or less in use. The operation was only over a portion of the first winter, and rather intermittent and not at nearly such a regular pressure during the second winter; but last winter, for the first time, we were able to maintain the process satisfactorily—at least after the early months, when we got the two large receivers installed.

During these winters it is gratifying to know that we have progressively lessened our troubles from naphthalene stoppages; last winter being the best we have known. This is particularly satisfactory, as other undertakings experienced such heavy trouble in this direction during that period. Actually during last winter we only had three cases of naphthalene stoppage which gave us any trouble at all; and these were so similar as to be worth noting. The three cases were considerable distances apart (between one and two miles at least), but each stoppage occurred approximately thirty yards beyond a reducing piece in a straight main, and in each case, oddly enough, the reducer was from 12 in. to 6 in. with the deposited naphthalene about thirty yards along the 6 in. pipe. For dealing with these contingencies, we have a portable spray which we find very effective, and which works a spray painter a good deal oftener than it is needed for naphthalene. This little experience points to the importance of friction as a factor in precipitating naphthalene deposits.

Having in mind the desirability of an oil film on the interior surfaces of mains and services, and the idea of benefit to meters by oil, from the first we sought to combine a lubricant with a naphthalene solvent. Various mixtures have been tried, and neutral lubricating oils used. The difficulty of carrying forward the lubricant was early encountered, and we have not been able to use that quantity which we had hoped. At the present we use about 5 p.ct. to 8 p.ct. of lubricant in our mixture, but I hope in this direction to obtain better results if I can select a suitable lubricant from the same base as the solvent, and so get a proper solution of the heavier oil in the lighter spirit. Meanwhile, examination of various solvents has been very interesting and instructive; so much so that, without any claim to novelty or finality, I venture to record the results so far obtained.

From the outset we used petrol as the principal solvent in all our mixtures, on the assumption that its specific gravity and volatile nature would be of practical value. A little under twelve months ago, arising out of the publicity given to certain advertised naphthalene solvents, and their producers' claims, I examined two such special products for their solvent effect on naphthalene in comparison with the No. 3 motor spirit we were then using. We passed a stream of gas through N/20 picric acid solution in two wash-bottles, and then bubbled it through the solvent and passed it on through a tube of naphthalene crystals. The results indi-

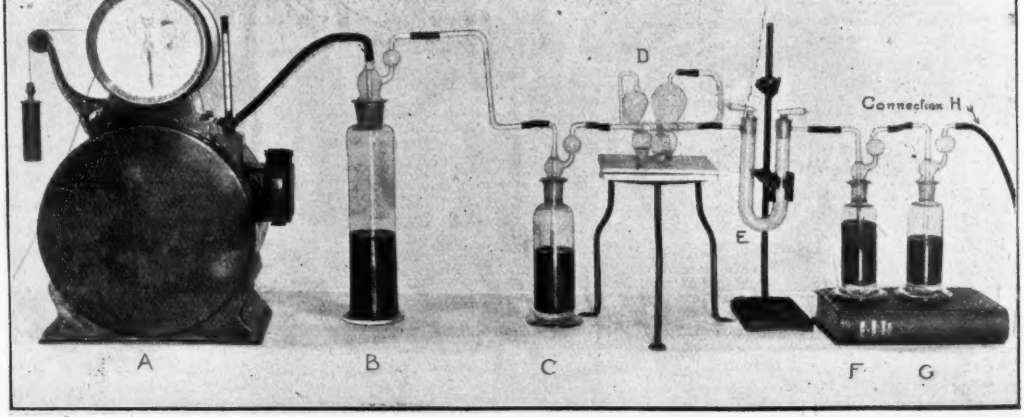


FIG. 4.—TEST FOR NAPHTHALENE SOLVENTS.

Tabulated Results of Examination of Naphthalene Solvents.

Test Number and Description.	A. Amount of Solvent Tested, C.C.	B. C.Ft. of Gas Required to Evaporate Solvent.	C. Weight of $C_{10}H_8$ Absorbed, Grains.	D. Solvent Absorbed, Grains per 100 C.Ft.	E. Solvent Absorbed, Gallons per Million C.Ft.	F. $C_{10}H_8$ Taken Up, Grains per 100 C.Ft.	G. $C_{10}H_8$ Taken Up, Lbs. per Million C.Ft.	H. Room Temperature.	I. Lbs. per Gallon of $C_{10}H_8$ in Liquid Solvent at 60° Fahr.
1. Aviation motor spirit	23	12	2·32	191·7	421·7	19 3	27·5	60	0·714
2. No. 1 motor spirit .	23	25	1·85	92·0	202·4	7·4	10·57	60	0·665
3. No. 3 motor spirit .	23	26	1·54	88·8	195·3	5 9	8·4	60	0·454
4. Solvent B.	22	27	1·47	81·5	179·3	5·4	7·7	60	0·407
5. Best paraffin . . .	10	90	0·25	11·1	24·4	0·27	0 38	60	0·389
6. Solvent A.	22	73	2·6	30·1	66·2	3·5	5·0	60	0·675
	Gas passed through apparatus at 1 to 1½ c.ft. per hour.								

cated that, in order of efficiency in picking up naphthalene, as used by us, the petrol came first, with solvents A and B (the advertised articles) second and third. Following this we tested each of the solvents in liquid form to approximate saturation point with naphthalene. These figures confirming the first results, we felt justified in continuing the use of petrol, as the prices were very close. Actually solvent "A" was a 1d. more and solvent "B" a 1d. less than the petrol at the time.

Desiring to have a more carefully noted comparison, and also to extend the range of solvents by including further grades of petrol and a good-class paraffin, we arranged a test apparatus, shown in fig. 4, which operates as follows: Gas is drawn through the apparatus by a water pump attached to the connection H. The volume is measured by meter A; wash-bottles B and C contain N/20 picric acid solution to provide a naphthalene-free gas. Bubbler D, containing 25 c.c. of the solvent to be tested, provides bubble contact in the three lower bulbs, to permit the gas to carry forward its quota of solvent as vapour at the temperature prevailing. The solvent-saturated gas is passed through U-tube E packed with a weighed quantity of $C_{10}H_8$ crystals. The wash-bottles F and G, containing N/20 picric acid, recover (for check against actual weighing) the $C_{10}H_8$ picked up by the solvent-laden gas stream. The results are shown in the table [at head of page].

No. 1 shows the results with "Aviation" motor spirit of a well-known brand. No. 2 is No. 1 motor spirit, No. 3 is No. 3 motor spirit as previously used. No. 4 is the solvent B first examined. No. 5 is a good-class lamp paraffin, and No. 6 the solvent A.

In these tests, we tried to secure the comparison of a like quantity of each of the solvents; but the great variation in the affinity of the gas for the different samples made this impracticable. Hence, Column A (c.c. of solvent used in each test) shows at once that petrols lend themselves well to evaporation in gas. Column B, showing the volume of naphthalene-free gas which picked up the spirit, further unmistakably emphasizes the superiority of petrols for atomizing. Column C shows the weight of naphthalene crystals carried over in the solvent-charged gas (checked by recovery in the final picric acid bottles). This figure, it must be understood, is not put forward as having any particular reference to the action taking place in our mains when atomizing. It is a handy means of comparing by laboratory operation the active solvent property of each sample when suspended as vapour in gas, and has been ascertained and is shown only as such.

The other columns show particulars extended by calculation from the data in columns A, B, and C. Thus D and E show, respectively, in c.c. and in gallons, the rate per 100 c.ft. and per million at which each solvent evaporated into the gas. Columns F and G in similar manner show the crystal naphthalene in grains per 100 c.ft. and lbs. per million c.ft. of the solvent-charged gas picked up. The mean room temperatures during the tests are stated in Column H. Column I, where is shown the amount of crystal naphthalene dissolved in each solvent as liquid to saturation point at 60° Fahr. provides a contrast with the figures in columns F and G. This clearly shows that solvent A (test 6), while an active solvent, is not at all comparable with any of the others (except paraffin) as an atomizing medium. Paraffin recondensed in passing through the naphthalene crystals and in the picric acid solutions, and is obviously not suitable for spraying through atomizers. The comparisons obtained show very clearly that petrols are the most effective of the samples examined for atomizing for the prevention of naphthalene deposits in the distribution system. During the past two years, we have had great benefit from the atomizing practice, and have averaged 6 to 6½ gallons of solvent per million c.ft. of gas made.

THE RISING GENERATION.

In an address of this nature one may congratulate the industry on the success which promises to accrue from the education scheme of the Institution of Gas Engineers. Without a doubt the industry can provide scope for all the scientific and technical training that can be brought to bear upon it. Chemical control particularly is now coming into its own; but the industry we serve, in common with many others, runs some risks in this matter of the preparation of the rising generation of executive officials, and I propose to touch upon these. The points I want to indicate briefly are two. The first centres round what is often referred to as "the age of the specialist," and is the risk of producing a condition when the general practitioner of our industry—the man in whom the control of technical and scientific effort must be vested with commercial responsibility and administrative ability—may become a rarity. Incidentally this risk occasionally produces a very undesirable type of scientific pedant, and all too frequently fosters swelled head among juniors; who many times, unfortunately, need reminding, or find to their cost, that education, like a firearm, is a powerful asset when properly applied, but constitutes an equally powerful menace in the hands of a poor marksman.

The other risk is a very real one. No curriculum has as yet come into prominence for the preparation of our young men for the important duty of controlling and directing the human machine. Why this most important qualification should be so long in emerging from the rule-of-thumb régime of "live and learn," when the handling of plant and processes mechanical and chemical can command the best brains of our universities and colleges, is really difficult to see. The possibilities of proper preparation in this regard are surely important enough to warrant attention. Industrial conditions certainly demand that confidence between employer and employee shall be fostered and developed; and this in our own industry, among others, is vitally dependent on an executive staff whose preparation for the responsibility is largely left to chance.

The Institution of Gas Engineers, as the parent of our national organizations and the centre of our district technical associations, can at any rate be complimented upon its many-sided and effective interests. The British Commercial Gas Association, performing as it does its functions with a width of outlook and resourcefulness which appears to expand continually, is an asset very difficult to appraise in value. The National Gas Council with its constant vigilance in all matters affecting the general welfare of the industry and its activitiy in parliamentary work in particular, more than justifies its existence. The Federation of Gas Employers, with its Industrial Council, and Regional Councils, though perhaps least spectacular, possibly most continually and comprehensively employed, has filled its place with a success so far unsurpassed by any other member of the family. How long the unnatural estrangement between employers and employed will be in succumbing to mutual confidence and trust, one hesitates to predict. Certainly up to the present our own industry has gone as far as many, and much further than some, in avoiding ruptures and improving relations; and while one finds it impossible to suppress regrets at the lost personal touch in much of the collective bargaining of our times, it is a satisfaction to know that our organizations as a whole have served us well and show no signs of inefficiency or of inability to meet the ever-changing requirements of our development.

A VOTE OF THANKS.

Mr. W. W. Atley (Stockton) proposed a vote of thanks to the President. He said that, while the address was not open to criticism, he might be permitted to say that Mr. Shadbolt had given them a very striking illustration of how to use second-hand plant. He had had the pleasure of looking round the works, and it was an eye-opener to see how the plant so purchased had been efficiently installed. Most of the plant had been erected under war-time conditions, and they all realized what difficulties this entailed. Mr. Shadbolt was an advocate of low-grade gas. In this connection the capacity of the distribution system was a ruling consideration. He observed that Mr. Shadbolt had had trouble with concrete roads; and he (the speaker) knew from experience what this meant. The President was doing the correct thing in laying mains under the footpath. He (Mr. Atley) agreed as to the importance of chemical control. In complimenting the President on his address, he remarked that the Directors of the South Bank Gas Company were to be congratulated on having such an Engineer at the head of their works.

Mr. F. P. Tarratt (Newcastle-upon-Tyne) seconded, and said that Mr. Shadbolt had been of great help to the Association ever since he came into the district. He had also been a useful member of the Council of the Federation. It was satisfactory to find that he appreciated the useful work that the Federation had done in regard to labour matters. They had passed through difficult times since 1914, and the assistance which Mr. Shadbolt had given them on the Regional Council had been of material benefit. He was a man with a broad outlook who at the same time did not disdain to look into the details arising at a small works.

The vote was heartily accorded, and the President briefly returned thanks.

The meeting then turned to the consideration of a paper by Dr. Geoffrey Weyman, which will be found on the next and following pages.

THE PRODUCTION OF SULPHATE OF AMMONIA.

By GEOFFREY WEYMAN, D.Sc.

[A Paper read before the North of England Gas Managers' Association, Oct. 10, 1924.]

The proportion of nitrogen recovered in the form of ammonia during the carbonization of coal is so exasperatingly small that a brief review of the manner in which losses occur may be useful.

In carbonization the bulk of the nitrogen of the coal remains in the coke, from which it appears to be practically impossible to recover any appreciable quantity without gasification of the carbon. When the coke is gasified in a producer or similar generator, it is true that a very large proportion of the nitrogen may be recovered; but one is faced by difficulties due in the first place to the small concentration of ammonia in the gas, and in the second place to the fact that the purpose for which the coke is gasified does not permit of the maintenance of suitable conditions for ammonia recovery without serious loss of thermal efficiency. In a case in which producers fired on coke were used for heating a retort setting, only about one grain of ammonia per 100 c.ft. could be discovered in the gas. Blue water gas from a water gas plant contains normally but very little more. It is evident that the nitrogen which is left in the coke must be regarded as lost.

The proportion of the total nitrogen which is volatile varies not only according to the total nitrogen content of a coal, but also in respect to the type of coal. This is due not so much to any modification of the manner in which the nitrogen is held in the coal substance, as to the intrinsic conditions which are set up when the particular coal is heated. Published figures indicate a higher proportion of volatile nitrogen than is usually obtained from Durham coals. The following results were obtained by the analysis of seven different cokes obtained from Durham coals carbonized under identical conditions, and show the relation between the nitrogen left in the coke to that originally in the coal.

Coal.	Nitrogen in Coal.	Volatile Nitrogen (by diff.).	Nitrogen in Coke.
	P.Ct.	P.Ct.	P.Ct.
1	1·16	24·14	75·86
2	1·19	26·05	73·95
3	1·25	21·77	78·23
4	1·31	14·51	85·49
5	1·35	26·85	73·15
6	1·42	20·43	79·57
7	1·44	35·69	64·31

The nitrogen in coke was determined some time ago in the case of a large-scale trial of horizontal retorts; and from the average of a large number of determinations it was found that 72 p.ct. of the nitrogen remained in the coke.

The formation of the thick and heavy plastic layers which are characteristic of Durham coals gives rise to slow and uneven carbonization which is largely out of control. Carbonizing temperatures are higher than those considered most favourable for ammonia recovery, but this would not appear to be a serious fault if the evolution of gas was steady and uniform, and if the gas as it is evolved could pass by direct paths to the retort outlet. It is very important to be able to visualize what happens; and the following experiment, on similar lines to those which Foxwell has carried out, provides a clear idea of the conditions likely to obtain. A vertical tube 1 in. in diameter was partially filled with a layer of coke. On top was placed coal. Both the coal and coke were carefully sized to pass a 4-mesh screen and rest on an 8-mesh screen. The top and bottom of the tube were connected to separate meters and pressure gauges. The coke layer was first heated by placing an electric furnace round the tube; and when the latter had attained a temperature of 900° C. it was gradually lowered so as to bring the coal layer into the heated zone. The gas passing away through each meter was noted. After about one hour, 0·010 c.ft. had passed from the top *via* the coal, and 0·908 c.ft. away from the base through the coke. The experiment was repeated; and as soon as gas was freely evolved, an attempt was made to force a larger proportion of gas out at the top through the coal layer by sealing the connection at the bottom. The pressure rose at the base to something like 4 lbs. per sq. in., when the connections burst. The amount of gas issuing from the top was 0·005 c.ft. up to this point. As Foxwell has pointed out, the ammonia in the gas issuing from the coal side is negligible. These conditions are ameliorated in practice for two reasons. In the first place the coal is charged into a hot retort, and the surface of coal against the retort walls is immediately converted into coke, the contraction of which affords a passage. Secondly, in horizontal retort plants the retort is never full, while in vertical retorts the movement of the charge tends to open avenues by which the gas escapes to the walls. It is obvious, however, that when the gas has a long and irregular travel there is every chance of the ammonia being decomposed. At the same time steam admitted to the retort cannot exercise any great beneficial effect, as it has little chance of penetrating the coke against the local gas pressures. The local fluctuations in pressure lead to leakage, and consequent local high temperatures, and to formation of scurf. Possibly the future may see established some method of carbonizing such as is foreshadowed by processes consisting of blending caking coal with non-caking materials, so that the shape of the charged pieces does not alter during carbonization. By suitable grading of the fuel the charge could be kept open and carbonization effected by internal heating. The proportion of the nitrogen recovered as ammonia will then be considerably improved.

The following table gives the forms in which nitrogen occurs at the outlet of the retort, and the equivalent in sulphate of ammonia per ton of the proportion of each form. Obviously these proportions and quantities vary with the method of carbonization and the design of the retort.

Form.	Equivalent $(NH_4)_2SO_4$; Lbs. per Ton of Coal.	P.Ct. of Total Nitrogen.
Nitrogen, total in coal	137·3	100·0
Nitrogen left in coke	96·1	70·0
Nitrogen as ammonia	27·1	19·7
Nitrogen as free nitrogen	6·5	4·7
Nitrogen as organic compounds (tar) .	5·0	3·6
Nitrogen as hydrocyanic acid . . .	2·6	1·9

The nitrogen in the coal is equal to 1·3 p.ct. of its weight, and that volatile to 30 p.ct. of the total nitrogen.

In effect, at the outlet of the retorts we are left with the ammonia equivalent of 27·1 lbs. of ammonium sulphate per ton of coal, corresponding to 374 grains of ammonia per 100 c.ft. of gas at the rate of 13,000 c.ft. per ton of coal. In condensation the equivalent of about 3·5 lbs. disappears in the tar, and of this only about 3·1 lbs. will be eventually recovered and returned to the sulphate plant. The virgin liquor is a very variable quantity, but may easily produce 12·6 lbs. of sulphate, leaving the gas to enter the scrubbers carrying 150 grains of ammonia per 100 c.ft., or the equivalent of 11 lbs. of sulphate. Losses occur due to the volatilization from liquors at the condensers, scrubbers, pumps, and storage wells. Under good conditions and if suitable precautions are taken, the loss should not exceed the equivalent of 0·15 lb. of sulphate.

SCRUBBING PLANTS.

Scrubbing plants are often very badly arranged. It is not always realized that it is absolutely essential, if the ammonia is to be anything like completely removed, that the gas and washing fluid should travel in counter-current system. Instead of clean water being put in at the clean gas end of the system, to be pumped through the apparatus consecutively until it finally emerges from contact with the crude gas and runs to the storage well, it is often found that liquor from the storage well is circulated round and round. Sometimes the excuse is put forward that ammonia left in the gas is good for the purifiers, but I have previously shown that ammonia is not necessary for efficient and complete purification. The presence of ammonia in spent oxide is very much objected to by the acid makers; and should ammonia get forward into the distributing mains and services, excessive corrosion is to be feared. There is then every reason for extracting all the ammonia, and it is quite practical to bring the ammonia content down to 0·5 grains per 100 c.ft. Usually it is considered good practice to allow 3 to 4 grains to pass away, and this represents a loss of about 0·25 lb. of sulphate per ton. The complete extraction of ammonia requires an efficient set of scrubbers or washers, a true counter-current system, and a temperature not over 60° Fahr. The time contact required for ammonia removal is fortunately very small, and high gas velocities are permissible. The chief difficulty is due to the low concentration of ammonia in the gas, which amounts to about 0·5 p.ct. by volume. To obtain a liquor of reasonable strength, a very small quantity of water has to be used for a large quantity of gas. Far too little attention has been given to the devices which must be used to distribute this water over the area of tower-scrubbers, with the result that when the makes of gas are low, the water is so small in quantity that the distributor allows it to dribble down one side of the scrubber while the gas goes up the other. Often only one set of tower scrubbers is available for makes of gas varying by 100 p.ct. in quantity. It would appear far better to have two or more sets of scrubbers of narrower diameter, so that on occasion a set may be shut down. The height must remain the same, depending on the number of scrubbers used to a set. Centrifugal washers are very efficient and are not so sensitive to variations in make of gas so long as the mechanical part of the machine is not working at less than the critical speed. The makers of such washers are often unaware of the critical speed, and a series of tests is always advisable to determine this figure. Unless this can be easily maintained, the washer is useless. With rotary washers the speed is also of importance in so far as it affects the retention of the film of liquid carried by the packing attached to the shaft. In such washers a number of compartments is substituted for the height of the tower scrubber; and as the number is relatively small, it is particularly necessary that there should be no slip between the compartments.

Even dilute solutions of ammonia have an appreciable vapour pressure; hence it has been suggested that the last few grains of ammonia should be removed by solution with dilute acid, which, until it has become neutralized, has no appreciable vapour pressure. This would save the scrubbing system a large amount of work, and allow of a stronger liquor being made. An acid wash would collect most of the pyridine, and this objectionable impurity could be removed before the neutralized liquor was added to the mother liquors of the sulphate plant.

Sulphate Plant.

Taking the loss in the scrubbing system at the equivalent of 0·25 lb. of sulphate per ton, we have entering the sulphate plant the equivalent of about 26·3 lbs. of sulphate.

Direct pumping of liquor to stills is not to be recommended. Not only is there difficulty in adjustment of the feed, but the flow is of a pulsating character and liable to give trouble in the formation of air-locks in the pre-heating system. An overhead supply tank to give gravity feed is very desirable, and permits of an arrangement for trapping any tar which may inadvertently enter the tank. Good working can only result if the liquor entering the stills is measured in some way. The simplest and most effective device which I have experienced is the "Rotameter." This consists of a tapered glass cylinder arranged vertically in the line of liquor supply to the stills. Inside the cylinder is a conical metal float of which the upper rim is nearly of the same diameter as the internal diameter of the glass, and which has several grooves cut at an angle. For the purpose of measurement of ammoniacal liquor we have had the floats specially made in steel; and these have been quite satisfactory. In use, the flow of liquor up through the glass tube causes the float to rise; and by virtue of the grooves the float keeps slowly revolving. The height of the float gives the rate of flow of the liquor, and the glass cylinder is calibrated to read directly in gallons of liquor per hour. It has been found to be remarkably accurate. The instrument not only allows of a measurement being made of the liquor used, but, as the liquor can be clearly seen through the glass, any tar is detected before it has reached the stills, while, of course, there is no exposure to the atmosphere.

In view of the recent publication of Mr. Parrish's book on the "Design and Working of Ammonia Stills," there is no need for me to enter into a discussion of this subject; but I might emphasize that plants of this sort have a critical capacity at which they will work most easily and efficiently, and that it is most important that plants should not only be correctly designed and proportioned, but only be worked at the proper capacity.

Dry Steam and Superheat.

An important consideration when new arrangements are under contemplation is the fact that you cannot sub-divide a workman, and a little extra convenience, even at a greater primary cost, may save a workman's wages in the end. The provision of dry steam also cannot be regarded as of too great importance. A few degrees of superheat constitute a real economy. If the steam to sulphate plants had only been measured in days gone by, a good many stills would not be now in existence. Attention might be directed to deposits in stills. One sample proves to be a very pure sample of pitch containing only 2·5 p.ct. of ash, which has been produced by the steam distillation of tar in the still. The thickness is about 1¼ in., and besides interfering with the still, it is evident that the sulphate must have been considerably contaminated with the tar oils distilled over into the saturator. A second deposit taken from an old type of still has assumed the shape of spherical balls which have apparently been produced by the steam forcing some nucleus against the top of the rounded hoods, where the particle has gathered sediment until, on the release of the steam pressure, the ball has dropped down to the tray below. A partial analysis showed a loss of 5·5 p.ct. on ignition, calcium sulphate 26·9 p.ct., and calcium carbonate 47·1 p.ct. The balance was chiefly alumina with a little silica. It is probable that the alumina has been the chief agent in gathering the sediment.

It is important to note that the thermal balance of a sulphate plant is a positive quantity. There is heat to spare; and the question arises as to the possible utilization of this waste heat. Mr. Parrish uses the heat of the spent liquor for pre-heating feed water to boiler plants. A small saving can be effected by using a portion of the spent liquor for making milk of lime—lifting the latter direct by air or steam pressure to the stills. This has an advantage in the fact that the attendant becomes aware if ammonia is passing away in the spent liquor. Other ways of utilizing heat will suggest themselves which are applicable to special circumstances. Sometimes liquors have to be evaporated. A heat exchange with air would provide warm air for purification or other purposes.

Design of Saturators.

The design of saturators is a subject which is worth experimental investigation. The quality and texture of the salt depends in the first place on the design of the saturator. The size must be such as to allow sufficient time for the same to build up into definite crystals, but there must be no quiescent places where rock salt can form. The distributor must cause intimate mixing of gases and liquid, besides giving the agitation necessary to keep all but the fully-formed crystals in suspension. A distributor which causes an upward whirling motion towards the centre, drawing the more acid liquor down the sides, would appear a desirable form. The use of centrifuges for separating the mother-liquor and crystals is rightly becoming universal.

The mother-liquor from the centrifuge should run direct back to the saturator, and the fresh acid required should be mixed with the mother-liquor *en route*. The return of mother-liquor through storage tanks is both clumsy and wasteful; and it may happen that the addition of cold liquor to the saturator prevents sufficient evaporation, so that the saturator "makes up." With a direct return of mother-liquor to the saturatr, draining-tables are best restricted or omitted altogether, the salt being ejected straight to the centrifuge. Otherwise a draining table is advisable, and should be so arranged that the drainings flow straight back to the saturator. The saturator bath is best kept at as low a free-acid content as possible. The best working strength is largely dependent on the design of the saturator and the concentration of ammonia in the still gases, but as a rule 3 p.ct. to 4 p.ct. acidity is sufficient. While the appearance of the salt is a good indication of the acidity, it is preferable to arrange for direct titration of samples from the saturator. Commonly, a Twaddel hydrometer is used to indicate the apparent specific gravity of the hot liquor withdrawn from the saturator, but the indications are hardly reliable enough for the best working. With 3 p.ct. to 4 p.ct. acidity, the contents of the saturator taken in this way will indicate 54° to 56° Twaddel, but the readings depend largely on the temperature. In the production of a salt of definite crystal grain and uniform size it is practically essential to adopt a continuous method of working. Instead of allowing the saturator contents to run low, and then making up the charge with fresh acid and mother-liquor—a proceeding which throws the acidity for a time up to 10 p.ct. or 20 p.ct.—the contents are maintained as nearly as possible to a common level for 24 hours at a time with an acidity of 3 p.ct. to 4 p ct., fresh acid being added to the mother-liquor before it enters the saturator. With a properly designed saturator, no formation of rock salt will occur; but as a safeguard the acidity of the saturator contents is increased to 8 p.ct. or 10 p.ct. free acid, and the ejector worked full out, so as to cause rapid circulation for a few minutes every 24 hours.

As a general rule, larger crystals are produced as the acidity of the saturator contents is reduced and the concentration of ammonia in the still gases is increased, but saturators which are either too large or too small produce a fine-textured salt. Traces of oil also tend to reduce the size, and cause irregular salting.

Naturally, when working at low acidity there is more risk of ammonia escaping if the plant is not properly controlled. A safeguard consists in fixing a small catch-box, which may take the place of the usual spray-trap, at the outlet of the saturator. This is fed with a supply of fresh acid which afterwards passes to the saturator as required. It is possible to recover pyridine from the acid used in such a catch-box; and for a time previous to the war we did recover pyridine, but the quantity, in our case amounting to about 3 to 5 gallons of crude oil per day on a 4-ton plant, was hardly sufficient to justify the continuance of the operation.

Centrifuging.

Centrifuging is an operation which demands far more skill and attention than is often given to it. The amount of separation depends on the speed of the machine and the size of the basket. The following is a table giving the speed for each size of basket, based on recommendations of the makers of the machines:

Size of Basket.	R.P.M.	Capacity. Cwt. of Sulphate per Charge.
21 in. by 14 in. . . .	1650	0·75
24 ,, 14 ,, . . .	1500	1 25
30 ,, 18 ,, . . .	1200	2·25
36 ,, 18 ,, . . .	1000	3·00
40 ,, 20 ,, . . .	900	4·50
42 ,, 20 ,, . . .	850	5·00
48 ,, 20 ,, . . .	750	6·50

It is essential that these speeds should be maintained. Baskets of a size over 30 in. in diameter must be accurately balanced, or it will be found impossible to run them at the correct speed. Bottom discharge is almost invariably used, and gives quite sufficient trouble. Perhaps the future will give us a simple and reliable mechanical discharge. It has often seemed to me that pneumatic means could be adopted. The material of the baskets is a matter of controversy. Steel baskets gradually corrode, and materially add to the colour of the salt when pyridine is present. Monel metal is coming into use, but the first cost is high in comparison with the usual copper. As the copper baskets always give first at the riveted joints, it would seem a good plan to have a seamless joint. Monel metal gauzes are certainly economical, and have been successfully used for some time. A recent promising innovation is the substitution of coco-matting or horsehair matting in place of metal gauze.

The filling of a centrifuge is an important matter. The best practice appears to be that in which the wet slushy salt is gradually fed into the slowly revolving basket. The speed is gently accelerated so that an even layer of salt is gradually built up right to the top rim. The feed is cut off and the speed accelerated till the drainings diminish to a small trickle, the usual time being three to five minutes. It might be noted that drainage from the casing will often continue for some little time after the mother-liquor has been reasonably expelled from the salt. As the crystals of sulphate are gradually growing during the time of centrifuging, the size of crystal can be increased by filling the rotating basket very slowly and allowing plenty of mother-liquor to pass along with it. If the salt is over-centrifuged, or if sufficient salt is not filled into the basket, there is a risk of the layer becoming so hard and dry that it has to be practically cut out. It is not generally appreciated that, as the salt layer forms on the basket and the salt packs, the remaining mother-liquor is thrust inwards towards the spindle, and has to find a path inwards and upwards till it is finally expelled near the top rim, where the salt is not so tightly packed. Owing to evaporation and other reasons, the acidity of

the liquor expelled increases as the centrifuging proceeds; and it is found at completion that the distribution of acidity is not uniform. The liquor remaining in the salt is more acid in the part along the interior surface (towards the spindle) and towards the top, but the total quantity of acid is greater in the bottom corner against the basket, which holds more liquor. If, after centrifuging, water is added to wash the salt, it will be found that it does not penetrate the salt layer in the lower corner, but tends to rise over the inner surface and pass out at the top. Hence the difficulty of removing the free acid by water washing.

Neutralizing and Drying.

It may be taken that if it is worth while manufacturing sulphate of ammonia, it is worth while neutralizing and drying the product. The difficulties in handling the old acid salt are sufficient to justify a change, while the additional capital cost and costs of working need be only very small in proportion to that belonging to the rest of the plant. It would be invidious were I to describe or compare any of the many processes or apparatus which exist; and I will merely point out the difficulties which have to be overcome. The necessity for neutralizing lies in the fact that impure (and possibly pure) sulphate of ammonia is not stable in the presence of water at 100° C., the solution becoming acid. In order to secure sufficient evaporation in the saturator, it is necessary to work at a temperature of at least 100° C.; the usual temperature being about 105° C. In these circumstances a neutral (or alkaline) solution of sulphate becomes acid, the gain in acidity being promoted by the presence of sulphur compounds. Generally speaking, the free acid in centrifuged salt runs from 0·15 p.ct. to 0·50 p.ct., though in exceptional circumstances it may be much higher. With a salt of definite crystal grain and—an important point—of even texture, containing little or no fine particles, the acidity will be about 0·25 p.ct. The problem then is to distribute an alkali so as exactly to neutralize this free acid without interfering with the texture or character of the salt. Any alkali may of course be used, and the distribution of the alkali is materially aided by ammonia gas which is liberated either from the neutralizing agent added or by decomposition of the sulphate by the agent. At the present time, purity of salt has such a commercial value that the use of ammonia in some form or another is to be preferred. For distributing the neutralizing agent the centrifuge appears the best means; but, as already pointed out, a difficulty arises in the fact that a solution added during centrifuging passes upwards and out at the top of the basket, and an acid portion remains near the bottom. This necessitates leaving a sufficient excess of alkali to neutralize this portion when the salt is discharged; and in some cases where the salt is fine grained it has been found impossible to do this even when using strong solutions of ammonia. On the other hand, if the neutralizing agent is added after the centrifuge, it becomes necessary to use some mechanical device for mixing the salt and neutralizing the agent, and it is difficult to do this adequately without damaging the texture of the salt. When the salt is cold, it is more difficult to neutralize evenly; and if external heating is adopted, it is not easy to avoid premature decomposition and loss of ammonia.

Drying by heat is a process which needs very careful control. Sudden heating is liable to burst the crystal and produce dust, while an excessive temperature is very adverse to the production of a white salt. In one case a salt entering a mechanical dryer contained 9 p.ct. of salt passing an 80-mesh screen. At the outlet there was 21 p.ct.

A difficulty which affects both neutralizing and drying operations is the presence of pyridine and iron compounds. Pyridine present as pyridine sulphate in the acid salt is thrown out as liquid pyridine on neutralizing, and this forms a liquid coating on the crystal grains, which is very retentive of water. Diffusion of air and gases is hindered, and the salt becomes difficult to neutralize and dry. The iron present as ferrous ammonium sulphate does not colour the salt until the latter is made alkaline, when it is thrown out and, oxidizing in the presence of pyridine, forms a double compound which gives a most pronounced brown colour. It is possible, if neutralizing is carried out slowly and carefully, and the salt neither heated nor made alkaline, to produce a white salt; but it is almost, if not quite, impossible to carry this out on a commercial scale when the pyridine and iron contents are very high, and it seems best to keep both the iron and pyridine down to a minimum. It might be pointed out that no neutralizing or drying process can produce a first-class salt unless the salt before the final treatment is of sufficient purity and texture. A salt containing 21·10 p.ct. of nitrogen (25·66 p.ct. of NH_3) contains 99·5 p.ct. of sulphate, and it is obvious that there is little room for impurity.

Caking of sulphate is due to a process of solution and recrystallization. Any class of soluble salt, and even sand from the sea-shore containing common salt, will cake if the hygrometric conditions are altered. We cannot control the atmosphere; and even if sulphate is dried at 100° C., it will gain moisture from the atmosphere, with the result that any subsequent change of conditions will cause caking. For this reason sulphate should only be dried down to that point at which it is in equilibrium with the atmosphere. Salt of good texture is, of course, not so liable to cake as fine salt; but 20 p.ct. of dust present in a salt of otherwise good grain is more than sufficient to cause trouble.

Returning to the review of the recovery of sulphate per ton of coal, out of the equivalent of 26·3 lbs. of sulphate entering a sulphate plant, 25 lbs. of sulphate should leave, giving an over-all efficiency of 95 p.ct. Such a recovery is perhaps not one to boast of, but at the same time it is difficult to see any great improvement unless carbonizing conditions can be altered.

I wish to acknowledge the courtesy of Mr. F. P. Tarratt and of the Newcastle and Gateshead Gas Company for their consent to the publication of information I have given you.

Discussion.

The President remarked that Dr. Weyman had made a special study of sulphate of ammonia, and had reached the stage when he was commercially interested in certain processes. Because of this, he (the President) had found it difficult to persuade him to overcome his natural diffidence about giving a paper on the subject. Dr. Weyman had made the study so completely his own that his contribution was bound to be of value for reference. They were all glad that Dr. Weyman had seen fit to put his private scruples into his pocket, and give them the benefit of his knowledge.

Dr. W. B. Davidson (Newcastle) said the paper was full of instructive matter, and they were obliged to the author and to the Newcastle Gas Company for it. It was pleasing to find that in gas-works no secrecy was observed about processes, and sooner or later everything became the property of the gas industry. The same thing was not found in the chemical industry. Dr. Weyman had spoken of the difficulty of obtaining nitrogen from producer gas, but he (the speaker) did not think this was difficult, for, though the concentration was only one-half or one-third of that in coal gas, it was not hard to obtain it by the direct process. If they paid the usual price for acid, then the process would not pay unless the plant was a very large one and the coal very cheap. It was certainly remarkable that Dr. Weyman had found the distribution of nitrogen to be 70 p.ct. in the coke. In the Midlands they used to reckon, rightly or wrongly, that the coke contained 50 or 55 p.ct. of the nitrogen. In stating that it was usual for three to four grains of ammonia to pass away, Dr. Weyman did not mean that this passed away with the gas through the purifiers. This seemed to him a little ambiguous. Though occasionally small quantities of ammonia did get past the purifiers, no one nowadays would expect to get more than a fraction of a grain—or even less—in the purified gas. Many years ago, as some of them would remember, four grains of ammonia were allowed in the gas. He would also like to question the figure of 95 p.ct. efficiency given at the end of the paper. A loss of 5 p.ct. seemed to him rather heavy.

Mr. A. W. Branson (West Hartlepool) thanked Dr. Weyman for his paper, and said he was only sorry that the Association did not publish their proceedings, so that it could be preserved. Dr. Weyman had referred to the use of monel metal in place of copper and steel, and he could say that they had found it an added benefit. The life was four times as long, and the cost of a discharge valve in monel metal was only one-third of the cost of a copper one.

Mr. R. S. Shadbolt emphasized the point made by Dr. Weyman that the complete extraction of ammonia required an efficient set of scrubbers or washers, a true counter-current system, and a temperature not over 60° Fahr.

Mr. C. D. Drury (Sunderland) proposed a vote of thanks to Dr. Weyman for his paper. They all felt that the author was an expert in the manufacture of sulphate of ammonia, and they were greatly indebted to him. In fact, the industry generally was indebted to him for his original research not only in this but also in other subjects. There was no need for him to lay stress on the importance of the subject in these days when, in view of the competition with which they were faced, they had to be careful to send out the best salt they could manufacture. The suggestions and hints which had been thrown out by Dr. Weyman would be most helpful to them, and they were all the more valuable because they were so practical. What had struck him was that Dr. Weyman had given them a simple method of getting rid of the bugbear of pyridine, at any rate of reducing it considerably.

Mr. A. E. Ruffhead (Darlington) seconded, and said he would like to know how to make sulphate of ammonia more cheaply, to make its production worth while. They were getting on to the border line between profit and loss.

The President, supporting, said that in the South a number of gas engineers were experimentally using soda, instead of lime, as an alkali in the process in the still. The primary consideration was whether the cost would justify the benefit. When all was said and done, the recovery of residuals should be looked at in the light of sound economics; and he felt that sometimes there was a disproportionate tendency to chase residuals.

Dr. Weyman, in replying to the discussion and the vote of thanks, said that ordinarily it was not worth while to reduce the temperature of the gas in order to recover ammonia. He did not suppose anybody could allow three or four grains of ammonia to remain in town gas without getting into trouble. As a rule, any ammonia which passed the recovery plant was picked up by the purifiers. He was glad to hear of Mr. Branson's experience with monel metal, for he had found it advantageous.

On the motion of Mr. Branson, seconded by Mr. Barrow (Sunderland), the Chairman and Directors of the South Bank and Normanby Gas Light and Coke Company were thanked for their hospitality.

Southern Association of Gas Engineers and Managers.—The Hon. Secretary (Mr. W. H. Bennett, of Redhill) intimates that the general meeting of the Association will be held at the Charing Cross Hotel, Strand, W.C., on Tuesday, Nov. 25, at 2 o'clock. Two papers will be read and discussed, after which tea will be served. The full agenda will be announced later.

Society of British Gas Industries.—The autumn general meeting of the Society will be held at the Hotel Victoria, Northumberland Avenue, London, W.C., on Wednesday, Nov. 12, under the Presidency of Mr. D. Milne Watson, D.L., M.A., LL.B. The business (which will be preceded by luncheon) will include an account by the Chairman of the Council (Mr. J. Wilfrid Drake) of the work of the Society during the past six months, and a paper by him on "Some Aspects of the Metric System."

PURIFICATION OF GAS.

By R. A. WESTON, of Norwich.

[A Paper read at the Meeting of the Eastern Counties Gas Managers' Association on Oct. 8.]

The multiplicity of matters which in these days engage the attention of able technical writers in our great industry, renders it somewhat difficult to select a subject for a paper which will be of interest and at the same time render good service through a useful discussion. I esteem very highly the President's invitation to make a contribution to the Association. After some thought and inquiry, it occurred to me that a few observations on the subject of purification would perhaps be acceptable and of some service. In reviewing and speaking of purification in everyday practice, we usually regard purification of gas as commencing at the outlet of the condensers, and sometimes in our minds even limit the process to the oxide purifiers only. To view the matter more correctly, however, the purification starts immediately the gas leaves the retorts; and the efficiency of the subsequent apparatus is in a degree dependent upon the treatment the gas receives at this early stage. The purification process may be divided as follows:

(1) Condensation—by which the permanent gas is cooled to approximately atmospheric temperature, and so separated from the condensible hydrocarbons and aqueous vapours, with the removal of some portion of the acid and alkaline impurities.
(2) Tar fog extraction for the more complete removal of the vesicles of tar carried by the gas in the form of fog, by a washing medium or by mechanical means.
(3) Ammonia extraction in which use is made of the ready solubility of ammonia in water, in the course of which, by means of suitable plant, advantage should also be taken of the affinity of the alkali for the further removal of as large a portion as possible of acid impurities, CO_2 and H_2S.
(4) Sulphur extraction for the complete removal of sulphur in the form of H_2S, and the elimination, as far as is economically practicable, of sulphur in other forms.

It is proposed in this paper to review in some detail these various phases of the purification process, in the light of recent experience with gas produced by the vertical retort installation at Norwich, and also to deal with various methods of purification of gas from horizontal retorts both at Norwich and at other works.

Fig. 1 illustrates the arrangement of the purification plant of three million c.ft. per diem normal capacity (dealing with the gas from the vertical retort section at Norwich), which plant consists of a pair of water-cooled condensers, a centrifugal washer and a rotary washer, and two complete sets of oxide purifiers. It will be observed that the exhausting plant is interposed between the ammonia extraction plant and the oxide purifiers, instead of in the usual position at the outlet of the condensers. The conditions are otherwise unique in respect of the length of about half-a-mile of foul main between the outlet of the ammonia plant and the exhausters, by reason of the works being on two distinct sites.

The temperature of the gas in the collecting mains above the vertical retorts is much higher than is usual in the hydraulic mains of horizontal settings, being approximately 300° Fahr., in consequence of which condensation in these mains is limited to the heavier tar vapours. Some considerable observation and experiment were necessary on putting the vertical section to work, in order to discover how to ensure the avoidance of accumulation of viscid tar in the mains and the connections to the condensers. Our practice is to take one collecting main daily for treatment by working it empty and passing a continuous supply of liquor, from a ¾-in. connection, through the main for 24 hours. While this is done, the other mains are worked normally, filled to the gas offtake with liquor, and flushed out every eight hours. Liquor is also supplied at various points along the length of foul main between the collecting main outlets and condenser inlet; and in this way the whole collecting system is kept clear of thick tar or other obstruction. The gas enters the condensers at an average temperature of 160° Fahr., and leaves at an average of 70° Fahr.; the gas passing through the condensers in counter-current to the water, and the apparatus being worked in series.

In the interest of maintenance of efficient conductivity it is important that the tubes be kept clean by scouring them through at regular intervals with a suitable steel wire brush, and that the gas flow through the condensers be reversed regularly to ensure the removal of any possible deposits by the condensates. A plentiful supply of water is available from the river, and is supplied to the condensers by gravitation from an overhead general works supply tank; the water being previously passed through finely perforated metal filters, to exclude organic and solid matter. Upon leaving the condensers, the gas enters a centrifugal washer, the principal function of which apparatus is the removal of tar fog, and some ammonia; the acid impurities also being recovered. The washer is driven directly through bevel gearing by a horizontal steam engine at about 120 r.p.m., and is fed by

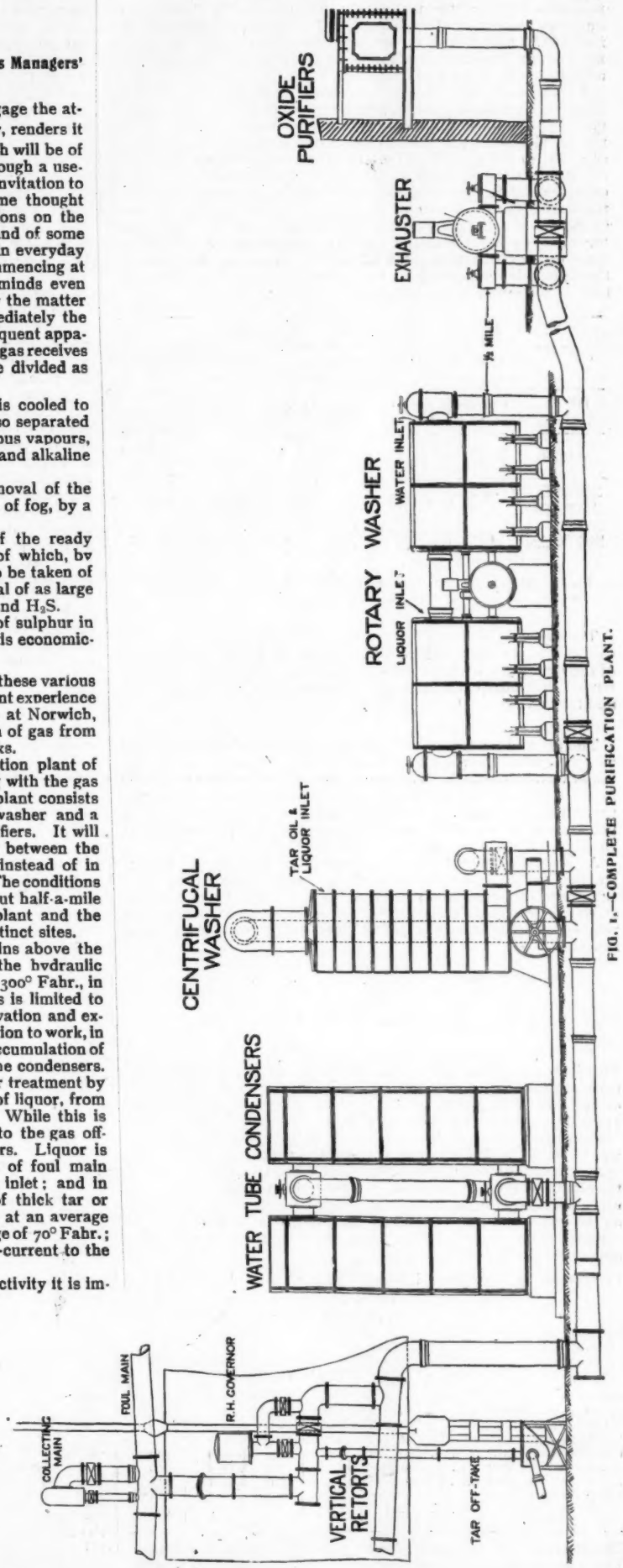


FIG. 1.—COMPLETE PURIFICATION PLANT.

gravitation from overhead tanks with light tar oils and weak ammoniacal liquor at the rate of ¾ gallon of oil and 2½ gallons of liquor per ton of coal carbonized. The rotary washer-scrubber follows the centrifugal washer, and here the removal of ammonia is completed; the washer being steam driven through worm and wormwheel at 2 r.p.m.

Ammoniacal liquor from the general receiving sumps is continually re circulated through the first section of four compartments of the washer by gravitation from overhead tanks at the rate of 1½ gallons per ton of coal carbonized, and clean water is supplied to the second section of four compartments through a low-pressure water meter at the rate of 4 gallons per ton of coal carbonized. Such tar as is deposited in the eight compartments of the washer is run off once every 24 hours. The wet purification of the gas is here completed. The method of working the plant having been described, the writer now proposes to describe in some detail the results obtained by such working. Fig. 2 shows the impurities contained in the gas at various points from the inlet to the outlet of the wet purification plant.

IMPURITY	INLET OF CONDENSERS	INLET. CENTRIFUGAL WASHER	INLET. ROTARY WASHER	OUTLET. ROTARY WASHER	INLET. OF PURIFIERS	REMARKS
	GRAINS PER 100 C. FT.	GRAINS PER 100 C. FT.	GRAINS PER 100 C. FT.	GRAINS PER 100 C. FT.	GRAINS PER 100 C. FT.	
TAR & TAR FOG	1700	1100	140	100	60	½ MILE OF 20" DIA FOUL MAIN & EXHAUSTERS BETWEEN OUTLET OF ROTARY WASHER & INLET OF OXIDE PURIFIERS
AMMONIA	210	140	80	1	1	
SULPHURETTED HYDROCEN	700	630	590	560	560	
NAPHTHALENE	20	6	4	2	1·5	

Fig. 2.—Statement showing Impurities in Gas at various points of Wet Purification Plant.

The figures given are the averages of numerous tests taken over a period of two or three months, and represent a fair average of the quantities of impurities to be dealt with. It is here intended to discuss each impurity separately, dealing first with tar and tar fog.

Tar and Tar Fog.

The tar and tar fog carried forward to the condensers amount to 1700 grains per 100 c.ft.—equal to about 3·6 gallons of tar per ton of coal carbonized. The heavy and medium tars are deposited in the collecting and foul mains prior to the condensers, and represent about 75 p.ct. of the total quantity of tar produced. The presence of tar fog in the ammonia scrubbing plant is very undesirable, and still more so in the oxide purifiers.

At Norwich the centrifugal washer is used with tar oil for extraction, but the gas after passing this apparatus still retains some 140 grains of tar per 100 c.ft. in the form of fog. From the tests given it is seen that the tar and tar fog entering the condensers are removed in the following percentages by the respective apparatus:

	P.Ct.
Condensers	35·3
Centrifugal washer	56·4
Rotary washer	2·3
Foul main and exhauster	2·3
	96·3

This leaves 60 grains per 100 c.ft. to go forward to the oxide purifiers, representing about 0·12 gallon per ton of coal carbonized, or approximately 3 p.ct. by weight of tar in the oxide. Samples of oxide examined by the writer from various works have been found to contain as much as 6 p.ct. of tarry matter. Reference will be made to this at a later stage of the paper.

An examination of the tars deposited at the various points of the plant is of interest, showing, as it does, that the heavier tars are first deposited; the tar condensates becoming increasingly lighter as the gas traverses the plant. The results of distillations of samples of tars collected from the syphons at the outlet of each apparatus are appended.

Comparison of Tars from Various Points of the Wet Purification Plant.

—	From Collecting and Foul Main.	Outlet Condensers.	Outlet Centrifugal Washer.	Outlet Rotary Scrubber.	Inlet Purifier Syphons.
Sp. gr. at 60° Fahr.	1·142	1·072	1·035	1·046	0·991
Naphtha, p.ct.	5·2	5·1	6·0	9·7	6·8
Light oils, p.ct.	9·5	20 8	27·3	29·8	35·0
Creosote oils, p.ct.	13·1	19·3	21·7	16·9	25·2
Anthracene oils, p.ct.	36·0	18·5	17·4	15·5	18·6
Pitch (by difference), p.ct.	36·2	36·3	27·6	28·1	14·4
Free carbon, p.ct.	10·05	5·20	2·20	1·54	1·30
Naphthalene, p.ct.	2·11	4·18	5·68	4·62	8·24

The above results are all expressed as percentages on the dry tar. The specific gravity shows a gradual fall—the drop in specific gravity of the tar observed at the centrifugal washer outlet being due to the addition of tar oil to this apparatus as a washing medium. Generally the light oil and creosote fractions of the tars show a steady increase, while the anthracene and pitch fractions decrease as the tars become lighter. The free carbon content also decreases, as would be expected from the pitch content. The gradual increase in the naphthalene content of the tars is interesting, and is doubtless due to the effect of fractional condensation as the gas traverses the plant, resulting in loss of the heavier fractions containing relatively less naphthalene.

It has previously been mentioned that between the outlet of the rotary washer and the exhauster is interposed the 20-in. foul main, about half-a-mile in length. The tars deposited in the drip pots on this main gradually fall in specific gravity from 1·046 to 0·991, and, as might be imagined, are somewhat difficult to separate, more particularly those tars of a specific gravity coincident with water. Before dealing with the method employed for separation, you will be interested in the manner in which such drip pots are cleared. During the course of a day a considerable amount of condensates, chiefly water, is deposited in the pots, which are discharged daily by means of compressed air; the condensates being delivered into a common 3-in. main. The drip pot is connected by a 2-in. pipe to a receiver below it. A discharge pipe is provided which extends to within 3 in. of the bottom of the receiver, and terminates in the 3-in. main. To ensure equilibrium of pressure conditions (in our case negative pressure), the drip pot is put into communication with the receiver by means of a 1-in. pipe fitted above liquor levels. In ejecting the condensates from the receiver to the 3-in. main, the cocks on the equilibrium and drain pipes are closed, and the cocks on the discharge and compressed air pipes are opened. A master valve is provided at the works end of the compressed air line, which valve is kept shut except when the receivers are being discharged. The method has proved to be simple and expeditious—the 3-in. main common to all the receivers delivering the condensates into a separating tank at the works, from which they are pumped to a column for complete separation. The separating column consists of a boiler shell, 7 ft. in diameter by 27 ft. in length, placed on end and provided with a run-off at the foot for removing the heavy tar, a similar connection at the top for the removal of light oils, and a further connection for running-off the liquor separating between the tar and light oils.

The mixture of tars and water from the separating plant is pumped into the centre of this column; the thick tar from the bottom of the column being run to the tar storage, and the light tars from the top to the centrifugal for tar fog washing, or to storage for other use.

The removal of tar fog does not in most cases receive the attention it deserves; the carrying-forward of varying quantities of tar being regarded as inevitable, resulting in avoidable pressure in the purifying system, and other evils.

There is some diversity of opinion as to the point at which the tar fog should be removed, but there appears to be little doubt that the heavier tars and heavier fog should be removed as early as possible; such tars, if left in contact with the gas, having a marked effect upon its quality. The lighter fog is undoubtedly a naphthalene solvent, as is seen by reference to the tests of tars deposited at various points of the plant, the naphthalene content being higher in the lighter than in the heavier tars. It would appear to follow that the light tar fog should be allowed to go forward up to the outlet of the condensers. The tar or oil fog will now be at a lower temperature, with an increased capacity for naphthalene absorption, but on the other hand it will be capable of absorbing a higher percentage of low-boiling constituents from the gas. In these days of thermal value, however, this is not an important matter; the fall in calorific value due to such absorption being trifling.

This view, I find, agrees with that expressed by Mr. Alwyne Meade, who, in his "Modern Gas Works Practice," states: "It would seem, however, that one of the most effective methods of dealing with the crude gas is to eliminate the heavy tars and heavy fog at an early stage, and to ensure passage of the light oil fog as far forward as the outlet of the condenser." There is no real difficulty in getting the light oil fog to the outlet of the condensers, but the prevention of its accompaniment by the heavier tar fog is rather more troublesome.

You are doubtless familiar with the methods generally adopted for the removal of tar fog, and it is not my intention to go into the details of apparatus. These methods may be briefly summarized as follows: (1) Mechanical means. (2) Washing.

The removal of tar fog by mechanical means covers all such apparatus in which the fog is separated from the gas by methods comprising the principles of centrifugal force, wire drawing, friction, or otherwise, where the vesicles of tar are caused to coalesce. Removal by washing involves the bringing of the gas into extremely intimate contact with a suitable liquid used as a washing medium, and is generally carried out by passing the gas through a bubbling washer charged with tar oil, by spraying the gas with light tars or tar oils, or by some other similar method.

As previously stated, the washing method is adopted at Norwich. There the gas passes through oil sprayed from the trays of the centrifugal washer. We have not, however, by this method succeeded in reducing the fog to a negligible figure. When working the horizontal retort plant at Norwich, the gas was passed through a Livesey washer containing a tar oil; and though unfortunately no figures are available for this plant, the tar fog was considerably reduced. It was interesting to notice through the observation

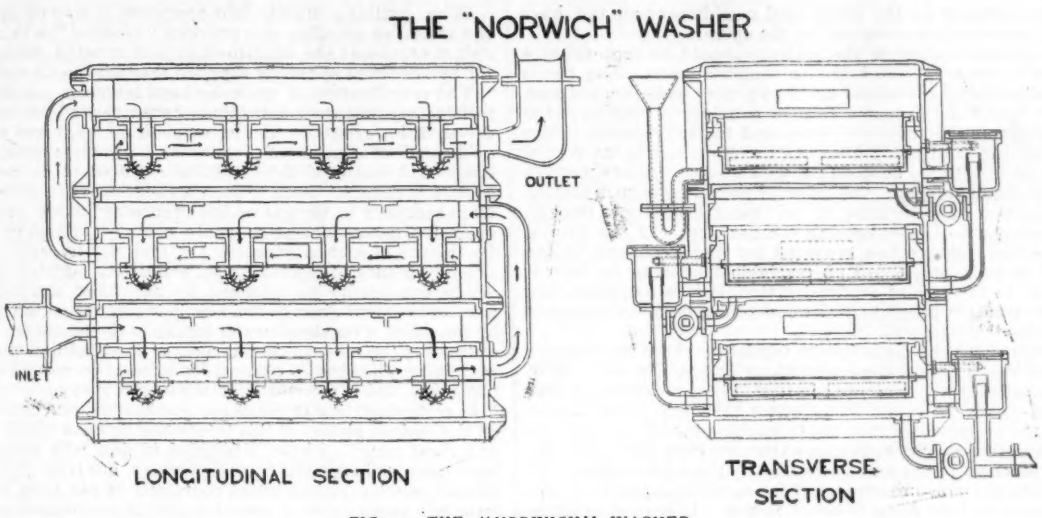


FIG. 3.—THE "NORWICH" WASHER.

glass of the Livesey washer that the light tar oil, in taking up the tars, gradually increased in gravity, the result being three distinct separations in the washer, consisting of oil, water, and thick tar. For keeping a constant level in the washer an arrangement is provided consisting of a continuous sight overflow removing the thick tar from the washer bottom.

The writer has recently been experimenting with a small bubbling washer designed by his chief, Mr. Thomas Glover.

Fig. 3 shows a section of this washer consisting of three trays, each having four slots through which the gas passes downwards through perforated sections and the washing medium, and up through a perforated plate kept just awash with the washing medium. In this way the gas, passing through two sets of perforation and the liquid in the washer, is subjected to friction and at the same time thoroughly washed. The process is repeated on the second tray, and further in passing to the outlet through the third tray.

The washer working with crude naphtha is found to be very efficient in the matter of tar fog removal; tests taken showing a tar fog content of 140 grains to be reduced to 2 grains per 100 c.ft. —equal to an efficiency of 98·6 p.ct. A similar washer erected at a small works using clean water for NH_3 extraction was found to reduce the tar fog from 250 grains to 70 grains per 100 c.ft.; and had naphtha or some such oil been used, the fog would have been reduced to a negligible quantity.

[Filter papers showing tar fog stains taken during the tests were exhibited.]

AMMONIA.

Determinations on the gas leaving the retorts show the ammonia content to be 262 grains per 100 c.ft. The ammonia is removed by the wet purification plant as follows:

	P.Ct.
By condensation	46·5
By centrifugal washer	23·0
By rotary washer	30·1
By purifiers	0·4
	100·0

One grain of NH_3 goes forward to the purifiers and is found to be beneficial in preserving the activity of the oxide. This grain of NH_3 represents 0·09 lb. of sulphate of ammonia per ton of coal carbonized. The removal of ammonia presents no difficulty, but should be carried out in such a manner as to make the greatest use of its property of combination with the acid impurities CO_2 and H_2S.

With this in view the liquor deposited in the collecting mains of the vertical retorts prior to the condensers is drained to separate sumps, whence it is pumped to an overhead storage tank for gravitation to the centrifugal washer and as far as possible to the rotary washer. The volume of liquor available being short of requirements, however, the balance is made up from the liquor deposited at the condensers. Owing to temperature conditions, the liquor deposited in the receiving mains contains a maximum of caustic ammonia, and is in good condition for removal of appreciable quantities of the acid impurities. From fig. 2 it is seen that the gas loses 140 grains of H_2S per 100 c.ft. in passing through the condensers and wet purification plant—equal to 20 p.ct. of the H_2S entering the condensers. Eighty grains of NH_3 per 100 c.ft. enter the rotary washer, and the four gallons of clean water per ton of coal carbonized (previously mentioned) supplied at the outlet end of this washer suffice to bring the NH_3 content of the gas down to one grain.

When working the horizontal retort section the gas after passing the Livesey washer for tar fog extraction was freed from NH_3 in a pair of tower scrubbers. These scrubbers date from 1875, and were filled with coke. They were more recently re-arranged and the coke displaced by wooden grids, resulting in their then dealing efficiently with the increased volume of gas produced in recent years. The re-arrangement of these scrubbers has already been published. The first scrubber is supplied with strong liquor for saturation with H_2S and CO_2; the second and final scrubber being fed with clean water at the head at the rate of 10 gallons per ton of coal carbonized. At about half the height of this second scrubber, weak liquor from the foot of the scrubber is re-circulated, and in this way NH_3 removal down to 1½ grains per 100 c.ft. is effected, together with appreciable quantities of acid gases, resulting in a finished liquor of 11-oz. strength. To prevent stoppage in the liquor sprays, the liquor pumps are arranged to deliver through strainers of metal plates with $\frac{1}{16}$-in. diameter perforations.

NAPHTHALENE.

The gas from the vertical retorts contains, at the inlet of the condensers, 20 grains of naphthalene per 100 c.ft., 14 grains of which are removed in the process of condensation, so that in the gas entering the centrifugal washer only 6 grains per 100 c.ft. are present. When the gas passes the centrifugal washer for tar fog extraction, a further two grains are removed; the rotary washer taking out a further two grains in the light tar deposited in the first chambers of this apparatus. At the inlet of the purifiers 1·5 grains of naphthalene are present; 0·5 grain having been lost in the condensates in the long foul main between the works. The naphthalene content of gas made in continuous verticals is very low as compared with any form of horizontal practice, and the light oil vapours going forward, as evidenced at the holders and on the district, render the two grains of naphthalene practically negligible.

The various methods adopted for dealing with excessive naphthalene content are well known, and for the most part consist of either removal of the excess by washing by solvents at the works, or the addition to the gas of hydrocarbon vapours of vapour tension coincident with that of the naphthalene. The subject, however, is rather beyond the limits of this paper, but in the author's opinion, the better way of avoiding the inconvenience and loss connected with this troublesome constituent is the re-arrangement of the carbonizing process to ensure a reduced proportion of naphthalene in the crude gas, and the production of a sufficiency of solvents which become liquid and effective absorbers of naphthalene on the cold surfaces of the condensers and in the subsequent mains and apparatus.

DRY PURIFICATION.

The complete removal of H_2S being a statutory obligation imposed on gas undertakings, it is imperative that such plant be provided as will ensure the complete removal of this impurity in all circumstances. Methods adopted in laying down such plant necessarily vary with differing conditions, but having ensured compliance with statutory requirements, the process of purification of gas from sulphuretted hydrogen should be further regarded as a chemical process for the extraction of sulphur; and, as such, the usual debit to revenue account may, in certain circumstances with careful management, be converted into an appreciable credit. With this end in view the lay-out should include such efficient mechanical appliances and equipment as will reduce the labour costs to a minimum. The realization of a credit balance also involves the sale of the resulting sulphur at its full market value, and the finding of a cheap source of hydrated peroxide of iron.

The purifying material used should contain the highest possible percentage of iron available as hydrated peroxide. The handling of inert material such as excess moisture, silica, or carbonate of lime adds to the working costs. The arrangement of the plant should be such as will secure the maximum time contact between the gas and purifying material that the size of the vessels relative to the volume of gas will permit; and the material should be so disposed in the vessels that they contain the maximum possible quantity. Arrangements should be made to ensure a safe measure of aeration and revivification *in situ*. The plant should be the

minimum nuisance to the works and neighbourhood, and have effective provision for safeguarding the operatives.

The moisture content of the material should be kept within a reasonable figure, 15 p.ct. being an ample amount. Bog ore is frequently supplied containing up to 50 p.ct. of moisture, and such material cannot be expected to give satisfactory results. It is hoped that some method will be devised for so preparing oxides for the market as to avoid involving the purchaser in the cost of carriage on this excess of moisture, with its consequent economic and other disadvantages. The material should be in such mechanical condition as will ensure its maximum exposure to the gas, with a minimum of resistance to the gas flow. In the case of natural oxides, nature has provided for the occlusion in the material of such proportion of vegetable matter as to keep it open; but in the case of artificial materials it is necessary intimately to admix a proportion of wood refuse or other approved material for this purpose.

Provision should be made for the regulation of the temperature of the purifiers; temperature conditions having a marked effect on the chemical activity of the material. Live steam being used for this purpose, there is a tendency for the oxide in the catch-boxes at the cooler end of the plant to increase in moisture content by condensation of the synthetic water resulting from the exothermic reaction in the first series and by the added steam. In view of this, the moisture content of the material charged to such boxes should be kept down to about 10 p.ct. It is good practice to preserve the chemical activity of these catchboxes by the admission at regular weekly intervals of a quantity of foul gas from the main inlet by a suitable by-pass.

Upon the efficient cleansing of the gas from liquid condensates depends largely the preservation of the activity of the purifying material. If tar fog is allowed to enter the purifiers, the oxide with which the gas first makes contact is used as a filter, and this renders it impervious to the gas, with consequent pressure and cessation of function for H_2S extraction, coupled with a fall in value of the spent oxide for acid manufacture. The admission of 2 p.ct. by volume of air suffices theoretically to deal with a sulphuretted hydrogen content of 560 grains per 100 c.ft., and in practice the admission of 2½ p.ct. of air is found satisfactory, leaving practically no free oxygen in the gas.

Such air is conveniently admitted through a wet meter charged with a crude petroleum oil in place of water, to avoid corrosion; the meter being connected to the inlet side of the exhauster. The provision of a filter box filled with cotton wool and fitted to the meter inlet is necessary to prevent dust from entering the meter. It will be found that the dust collected by such a device is surprisingly great. It is advantageous to work the purifiers in a downward direction, using a single layer of as great depth as the box can conveniently carry. In the working of purifiers nuisance may be reduced to a minimum by the provision of connections from the bottom of the purifiers to the exhauster inlet, by means of which gas contained in the box and occluded in the material is displaced by air, prior to lifting the covers. By such arrangement the operatives are protected from the foul gas, and the risk of ignition by sparks from picks or tools when emptying the purifiers is reduced. The arrangement can also be used for the aeration of boxes when standing between changes. Fig. 4 illustrates this method, which, used intelligently, ensures these advantages with perfect safety.

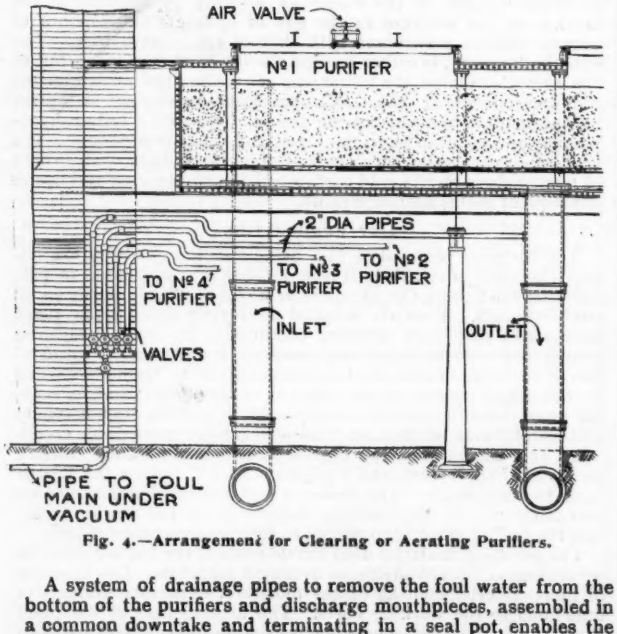


Fig. 4.—Arrangement for Clearing or Aerating Purifiers.

A system of drainage pipes to remove the foul water from the bottom of the purifiers and discharge mouthpieces, assembled in a common downtake and terminating in a seal pot, enables the liquid to be run away with avoidance of the unpleasantness otherwise necessitated with this operation. The best results are obtained by the adoption of backward rotation with three boxes of the first series in operation; the fourth box being shut out for aeration in the manner previously mentioned.

When putting a purifier into operation, it may be made first in the series, so avoiding any previous "blowing," with consequent risk of nuisance; the contained air sent forward being corrected for by reduction of the air supplied through the air meter.

The revivification of oxide by hand labour is a costly and unsatisfactory business; and this is better carried out by a power-driven disintegrator or similar machine of approved type. The oxide as discharged from the purifier is usually a mixture of hard lumps and smalls in dry condition required to be revivified by oxidation, reduced again to such a gauge as will ensure its maximum exposure to the gas without throwing undue pressure, and given the necessary free moisture content throughout the mass. By the use of such a machine the material is readily and consistently reduced to suitable size, aeration is secured to a degree which can hardly be matched by any hand method, and the moisture content given to and evenly incorporated in the material by providing a regulated water supply to the machine. The cost of treating the material in this manner is about half that of hand work, after allowing all charges for interest on capital outlay, repairs, &c., and is more satisfactory in every way.

In reviewing the subject of gas purification, one can but touch on the various phases of this interesting process within the limits of a short paper. I have attempted to deal with matters which have been well explored by able workers, but trust that the particulars relative to impurities contained in gas from vertical retorts with about 8 p.ct. of steaming, and the considerations involved in their removal, may be of interest and, perhaps, service to members of this Association. In investigating gas purification one is inevitably led to the fascinating possibility of the complete removal of the contained impurities by their mutual chemical combination. While the crude gas contains the compounds necessary for its own purification, they are not, however, present in the required proportion, so that to complete the process of purification by such method the NH_3 must be freed from its initial combination with the acid gases, to render it available for further reaction. The failure of the practical working of such a process has been attributed to the loss of ammonia, but the advantages of this method of purification are such as make the problem worth every effort of solution.

The writer is conscious that this contribution deals inadequately with a subject suited to a more able pen. He wishes to express his grateful thanks to his respected Chief, Mr. Thomas Glover, for the help and interest in the preparation of this paper, and for the facilities which have been so generously placed at his disposal. He is also indebted to his colleagues, Messrs. V. E. Harston, J. A. Scott, B.Sc., and F. H. Phillips, for their assistance.

Discussion.

The President (Mr. F. A. West, of Newark) said the paper was now open for discussion. He must congratulate Mr. Weston on his very excellent contribution. There were many points in it which he hoped would promote a good discussion. The purifying plant at Norwich was unique inasmuch as the exhausters were placed immediately before the oxide purifiers, and the exhausters and purifiers were on an entirely different site half-a-mile away from the carbonizing plant. Mr. Weston emphasized the importance of keeping up the temperatures in the purifiers for efficient results, and it was a question which was the best method of doing this—admitting live steam, heating the purifiers with a steam coil, or some other plan. He also rightly emphasized the importance of removing tar fog and preventing the oxide from being coated, thus reducing its efficiency. One of the disadvantages of the direct sulphate of ammonia recovery system was, he believed, the fine coating of sulphate of ammonia carried forward to the oxide. This was overcome by washing the gas in clean water immediately before the purifiers. Liquid purification was very fascinating; but with modern methods, where dry purifiers were changed only once or twice a year, many works had reduced the cost so much that the liquid process was perhaps not so important as it might have been. He had found it an advantage to use a large volume of weak liquor in the scrubbers, in preference to a strong liquor. While the strong liquor should remove more acid gases, the vapour tension of the liquor increased, and it appeared to be more difficult to remove the H_2S and CO_2. By increasing the flow of liquor, one got the same quantity of ammonia. He had had an interesting experience with sulphur compounds other than H_2S. He had at one time old-fashioned pipe condensers with a scrubber in the middle. The gas used to come from the retort house in two streams, and meet at the bottom of the scrubber. The scrubber was filled with boards on edge, and a pipe fed the scrubber at the top with a large volume of ammoniacal liquor. Of course, the gas and liquor were very hot. It was necessary to have practically a waterfall of liquor flowing through the scrubber to keep it clean. When they worked this, the sulphur compounds averaged 21 grains per 100 c.ft. Under the ordinary method they averaged 30 to 35 grains. It was an interesting point, and perhaps some of the members had had a similar experience. There was no doubt that an efficient and simple method of removing all sulphur compounds would be a great advance.

Mr. E. F. Keable (Gorleston) felt that he, also, must thank the author for his paper—particularly as he was instrumental in inducing Mr. Weston to come along and read it. Though, of course, it was only a minor matter, he would like to know what became of the flushing liquor alluded to in the early part of the paper. In the matter of tar fog, he himself was in charge of a small undertaking, but in 1911 he had some difficulty, which was overcome by the introduction of an Everitt tar extractor. Since that was installed there had been no trouble with tar fog going forward. The position occupied by this apparatus was in accordance with Alwyne Meade's practice in this connection, as quoted in the paper. He noticed Mr. Glover had adopted a washing medium. Why was this particular method selected, because it would appear from Mr. Glover's more recent washer that he was dealing with the matter along the lines of wire-drawing? It seemed

that at Norwich air for the purifiers was admitted on the inlet of the exhauster, and a wet meter was used. Why was this course adopted in place of a blower, which would give them an opportunity (as at his own works) of measuring the air by a mechanical counter, and, with a separate pipe on each box, of having the whole thing under perfect control? What was the size of the boxes?

Mr. J. R. BRADSHAW (Retford) remarked that the author quite early in the paper told them that the whole of the washing plant was under vacuum. Was this purposely arranged, or did it so happen because there was half-a-mile between the ammonia plant and the exhausters? They knew the correct percentage of moisture for oxide when they put it in the purifiers; but it was left there perhaps a year, and they had very little control over the percentage during this time—it was governed entirely by the amount of exposure to which the boxes were subjected, and the weather conditions generally. He agreed with the author that the oxide could not be broken properly by hand, but in the case of a small works he was forced to the conclusion that it did not pay to put down a machine for a job which had to be carried out perhaps during one week out of twelve months. Changing purifiers and breaking oxide provided a nice fill-up job in small works.

Mr. W. W. TOWNSEND (Colchester) remarked that it was a most interesting paper. He noticed that in the new purification plant there was one centrifugal washer and one rotary washer provided. What was done in the event of either or both being shut down for repair? The condensers were in duplicate, and so were the purifiers. It was quite evident that at Norwich they had been feeling their way in the matter of the extraction of tar fog. Even now, with their new centrifugal machine, they had an idea that the Livesey washer was very efficient for removal of tar fog, though they could not produce figures. Though the principal function of the centrifugal washer was the removal of tar fog, it did not carry it out as efficiently as would be wished, and he himself felt that a Livesey washer would do better. At his works he used a Livesey washer only, and with a filter paper on the outlet there was practically no trace whatever of tar fog. But an even more efficient apparatus was the "P. and A." extractor, and he knew from tests which had been made that this removed a good deal of the naphthalene. This was a rather valuable feature of the "P. and A." apparatus. He took it that the plan before them was not to scale, but he assumed that the water cooled condensers were quite close to the retort-house. One of the *desiderata*, according to the author, was that the light tar fog should be kept in contact with the gas as long as possible; and if the condensers were some distance away from the retort-house one got the advantage of this contact over a considerably longer period. This happened to be the case in his own works, and he was inclined to think it was a good thing. On the subject of naphthalene, he noticed Mr. Weston said, rather dogmatically: "The better way of avoiding the inconvenience and loss connected with this troublesome constituent is the re-arrangement of the carbonizing process." This was all very well. It was an advantage of vertical retorts that the naphthalene content of the gas was not so high, but he was rather surprised to find it was as much as 20 grains per 100 c.ft., after all they had been told about its absence. In condensation they got down to 6 grains, but even this was not negligible. In other stages, however, it was brought down to 1½ grains, which was negligible. But nobody nowadays need have any trouble with naphthalene; this had been conclusively proved in many ways. In his own works, with horizontal retorts at high temperatures, they used both the processes mentioned in the paper for dealing with naphthalene. Their content was from 15 to 20 grains on the outlet of the condensers, and he had for some years used various liquids in the rotary washer for reducing the amount. If he had a whole washer to devote to the process, he could get the naphthalene content down to the 1½ grains mentioned in the paper. He had not, however, a whole washer, and so got it down to about 4 grains; and to make sure of absence of trouble on the district, he vaporized paraffin into the gas. By the use of both processes, trouble with naphthalene was entirely avoided. There was one statement made in the paper which did not seem to him to be quite correct. Referring to the prevention of naphthalene, the author said that one method was the addition to the gas of hydrocarbon vapours of vapour tension coincident with that of the naphthalene. In the case of ordinary lighting paraffin, which he (the speaker) used, the vapour tension was not coincident, or anything near it, but it had the desired effect. As had been recently pointed out by more than one writer, the great point was to saturate the gas, and paraffin was valuable because a small quantity would do this. Benzole was not so valuable for the purpose because one had to use much more. He agreed that regulation of the temperature of the purifiers was essential, but he was not sure that live steam was the right way of doing it. He had heard of cases where live steam was used in quantity, but even the addition of a small amount would in his view upset all the arrangements. The one thing desirable to avoid was getting an acid oxide. If steam was added to the gas one was liable to have this happen, and some of the oxide got into a very sloppy condition, which was liable to cause back-pressure. It was better to go to the extra trouble of putting closed steam coils inside the purifier. A remark had been made about the addition of air at the inlet to the exhausters. Of course, in the case of Norwich (which was exceptional) the inlet to the exhausters was on the outlet of all the washing plant, so the plan adopted was all right; but he would like to draw attention to the last report of the Chief Inspector of Alkali Works, in which he said: "The greater part of the thiocyanate and thiosulphate present in ammoniacal liquors is due to oxidation changes taking place when air is present. By minimizing air leakage at the retorts, and by the admission of air (in cases where such admission is favoured) at a point immediately before the purifiers, the formation of thiocyanate and thiosulphate would be minimized, and in this connection cyanide recovery becomes a further point for consideration." Of course, the point was that it made the effluent liquors from sulphate plants very much more difficult to deal with when these were present. It was worth doing as Mr. Keable did; that was to put the air in at the inlet to the purifiers, and not to draw it in the easiest way at the exhauster. It was a very attractive system that was worked at Norwich for rendering purifiers clean before lifting the covers, but he must confess to having some doubts about the method. Drawing air into the boxes in this way might be all right with some oxide, but with certain very inflammable types, such as the artificial, it would be highly dangerous. He would prefer to draw in some inert gas, like nitrogen. The same thing applied in an even greater degree to revivifying the boxes by shutting one off and drawing air through it. He would be very much afraid of setting the grids on fire. A perfectly good way of getting over one trouble, he thought, would be by putting the box last for some time before emptying it. Mr. Weston in one place said the admission of 2½ p.ct. of air left practically no free oxygen in the gas. He would like to know the exact figure. Personally he had never been able to get down to less than 0·4 p.ct., whether admitting air or not. It was rather remarkable that this small amount seemed to get through, whatever happened. They were not told anything about the extraction of CO_2 in the various parts of the plant, and no reference was made to cyanogen. He himself made a test for cyanogen a few weeks ago, and found at the inlet of the purifiers 19 grains and on the outlet *nil*. In ordinary dry purifiers they had taken out the whole of the cyanogen.

Mr. J. W. AUCHTERLONIE (Cambridge) took it that there were vertical tubes in the water cooled condenser, but thought horizontal tubes would be very much more efficient, sprayed with light oils or ammoniacal liquor, or acting more as a hot scrubber, to which the President had referred as having reduced his sulphur compounds. The author said that liquor was supplied at various points along the length of foul main. Did he not find that he got the tar mixed with water in the form of an emulsion which was exceedingly difficult to separate out? The amount quoted of approximately 3 p.ct. by weight of tar in the oxide, rather showed that there was needed some wire-drawing of the gas before going to the washing plant. This brought him to a point made by Mr. Townsend. He (the speaker) had a "P. and A." extractor which was exceedingly efficient, but anyone who was thinking of installing this apparatus should have it in duplicate, so that one could be cleaned while the other was in action. He had a spare cylinder for his extractor, so that he could take off the top cover, remove the one in use, and replace it with a clean one. In a new installation he was going to have a Livesey washer; his experience of the "P. and A." did not lead him to re-introduce it. He was also going in for a horizontal condenser with the tubes sloping slightly, so that the gas would be baffled and the tar extracted. He would like to know what was the back pressure with Mr. Glover's washer. With reference to the drawing-in of air to displace the gas in the purifiers, he might say that just lately he had had a very unfortunate experience—the only one in twenty years. He was using Dutch oxide from the North of Holland, which was one of the oxides Mr. Townsend had referred to as being exceedingly fine. The lid was opened, the air went in, and in about half-an-hour the contents began to smoulder. They were now steaming these vessels before lifting the lids, so that the oxide would be damp.

Mr. J. FERGUSON BELL (Derby) said he had been greatly interested in the paper. There were many points one could touch upon. The sulphur compounds were less in the case of vertical retorts than with horizontals. As to naphthalene, he treated this as an impurity; it ought to be got rid of, or at any rate reduced to a negligible quantity, because in these days, when gas was used so largely for cooking, heating, and other domestic purposes, naphthalene stoppages must entail great inconvenience to consumers. He noticed that the author of the paper had his centrifugal and rotary washers under exhaust. This was the case at his (the speaker's) works until a few weeks ago. He, however, reversed this, and found that with this plant under *plus* pressure he got better results. The question of tar fog was very important. There was no doubt that if this tar fog did get into the purifiers, it seriously affected the work of purification; a very slight quantity of tar fog would reduce the activity of the oxide. It was necessary to put a certain amount of air into the purifiers, either directly or indirectly, because they must keep them in an active state. The same thing applied to ammonia. It was desirable to allow a very small quantity of ammonia to go in, but it ought to be so limited that the ammonia in the gas sent out was practically negligible. With reference to tar fog, he found that the "P. and A." extractor was very efficient, but he agreed that there should be two of the machines installed, because they got clogged.

Mr. THOMAS GLOVER (Norwich) said, with regard to Mr. Weston's great effort, he was very pleased to hear from friends that they appreciated all that had been done in this investigation. Mr. Townsend had said something about their feeling their way at Norwich. Well, he thought they were among the early workers on the subject of tar fog; and he might remark that it was not everyone who had given the results of the investigations they had carried out. However, he had placed such facilities at the disposal of Mr. Weston as had enabled him to make a very complete study of this subject, which he believed was one that hitherto had been scarcely touched upon, and he had made visible by the discs displayed at the meeting what was actually going on in the different parts of the apparatus. These discs showed the importance of the efficient extraction of tar fog, and they also showed that pieces of apparatus they were depending upon, and processes they had adopted, which they believed were doing very well, might not be doing quite so well as they thought. It was the duty of every one of them to know what was going into the purifiers, and to intercept tar fog at an earlier stage if possible; and Mr. Weston had shown in his paper that it could be done. Others had pointed out different ways of doing it. He (the speaker) used to admire the "P. & A." extractor, until he found many put out of use. Now he preferred washing the gas by their own tar oils, which he had found very effective. Water was very effective, but tar oils were much more so. The "Norwich" washer was used because it was bringing about much better contact of caustic ammonia with the tar acids, thus saving the purifiers and reducing the tar fog, as shown by the discs. He had expected to hear of the timidity of some of his brethren on the matter of drawing air into the purifiers. Mr. Townsend had referred to the admirable arrangement in use at Norwich for rendering the purifying material better for the men to enter, and then he went on to tell them of all the fearful things that might happen. But they did not happen. They had had fifteen or twenty years' experience, and they did not happen. Mr. Townsend had suggested that they might place inert gas in the purifiers, instead of air. Well, air was best for the purpose,

and was used quite safely. He had also suggested that they should put a box last for a time, so as to render it fit for the men to enter. All the pores of the material would be filled with coal gas, and if they could render the material innocuous by filling the pores with oxygen instead of this coal gas they were doing two good services—they were making the material better for the men to enter, and they were benefiting the material itself. This was practised with good results, and it also led to something further—the occasional aeration of the material *in situ* and the putting to work of a box again, without emptying. It did not, of course, do away with emptying, but it was sometimes very useful for rendering a box active when it had become inactive. He did feel greatly indebted to Mr. Weston for his persevering work, and to those who had helped him over several months in preparing the material for this paper. He had worked on it with great devotion, in the hope that it would be of interest and of use to the Association. He (Mr. Glover) was a believer in the need for these Associations to do technical work. He was not a believer—though it was believed by some—that the commercial side of the industry was everything. It was very important they should all realize that the service to the consumers began on the works, and that if they were not going to make a good, reliable article, it would be very difficult for the outdoor men to sell gas. If they did not give sufficient study to the many problems on the works, they would fail in their duty.

Mr. R. G. SHADBOLT (Birmingham) said he would like to take advantage of the opportunity to acknowledge the indebtedness of the Association to Norwich for not only this contribution but many others. ["Hear, hear."] Considering there was half-a-mile of main between the washing plant and the purifiers, and considering Mr. Weston very rightly made a point of the necessity of maintaining the temperature in the purifiers, he would like to ask whether they had had any difficulty in doing this during very cold weather Speaking from experience over the last thirty years, he had no hesitation in using live steam in his purifiers He had never had sloppy oxide. The amount of steam required was only such as did not adversely affect the moisture content of the purifiers. As to registering the air admitted, if they could guarantee that they were measuring all the air drawn in, the meter would be a safe guide; but this was not the case, because there were various cracks and crevices in every works, through which air was drawn at one time or another. He had come back to drawing in just the requisite quantity of air on the foul main to maintain a certain box in the series in such a state that it would take three minutes' exposure of an acetate paper to show sulphuretted hydrogen—regulating the quantity of air by increasing or decreasing the aperture through which it was drawn in. The author had drawn their attention to the fact that purification began the moment the gas was formed, and was not completed until the gas issued from the purifier. The various processes of condensing, washing, scrubbing, and dry purification were all so inter-dependent that really they formed one complete and complex whole. Regarding the President's remark as to weak liquor removing impurities more readily than strong liquor, he (the President) recalled an occasion when he was unable to keep the hydraulic mains filled with liquor, and had to use fresh water, and to his astonishment he found that, after passing the Livesey washer and tower scrubber, there was very little sulphuretted hydrogen in the gas.

The PRESIDENT remarked that it was with great regret that he was compelled to bring the discussion to a close. It had been most interesting, and personally he would have liked it to continue. Time was up, however, and he must perforce call upon the author now to reply. The members had had the privilege of visiting Norwich and seeing in operation the plant that had been referred to in this excellent paper, which described a most efficient system of purification.

Mr. WESTON thanked the members very much for the way in which they had received his paper. It dealt with matters that had many a time before been dealt with, though probably in a somewhat different manner. If it proved useful to them, he would be amply repaid for any trouble he might have taken in its preparation. At Norwich the live steam was admitted at the inlet of the centre valves, or in some cases at the inlet of the exhauster. They had experienced no trouble in this respect, so long as the temperature was carefully watched. The use of live steam in the purifiers could be abused, and then the oxide would become sodden. They had had the temperature up to 90°, but if it was kept round about 70° he did not think anything need be feared from the use of live steam. He agreed that weak liquor was the right sort to use in the purification plant, provided that the ammonia content of the liquor was caustic. Experience at Norwich had been that the sulphur compounds had been reduced with the oil washing. Some time back there was a process of oil washing for the removal of sulphur compounds. Replying to Mr. Keable, the liquor used for flushing the hydraulic mains went back to the sumps, and was taken to the overhead tank for re-circulation. As to the "Norwich" washer for tar fog, what they aimed at was to combine wire-drawing and washing in the same apparatus, and with this plant it was so done. Mr. Townsend had answered the question about the supply of air to the purifiers, by pointing out that the position of the exhauster made the method adopted correct in this particular case. The boxes were 30 ft. square, and the gas occluded in the material was 2730 c.ft. As to Mr. Bradshaw's questions, the plant was under vacuum from force of circumstances, the works being on two distinct sites; the arrangement was not with the idea of getting any better results in the purification system. Personally, he had had no experience with an oxide disintegrator in a small works As to Mr. Townsend's point about the centrifugal and rotary washers not being in duplicate (to facilitate repairs), he would point out that each of these machines was capable of dealing with 3 million c.ft. a day, and in the event of failure at the rotary washer, the centrifugal machine could be converted into a complete washer by splitting it, and arrangements had been made for doing this, though there was ground space for the provision of another washer at a later date. The condensers were about 100 yards from the retort house. In his remark about vaporizing, he had in mind that when the vapour tension was coincident with that of the naphthalene in the gas, and that vapour condensed, it would also bring the naphthalene out in solution. He quite agreed that a horizontal condenser might be better than a vertical one, but he had had no experience of it. The tar and liquor did not form an emulsion in the foul main. The "Norwich" washer threw 2½ to 3 in. pressure. They had not so far experienced any difficulty through drop in temperature owing to the half-mile of main between the different apparatus. Generally they had managed to keep the temperature at the outlet of the meters between 50° and 60° in winter. The air ought to be measured in some way, because even if some was drawn in at other points, they should know just what they were putting in deliberately. The oxygen content of the finished gas was 0·6 p.ct.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

Visit to the Birkenhead Gas-Works.

At the invitation of their President, Mr. H. E. Stone, A.M.I.M.E., the members of the Association, on Oct. 4, visited the Birkenhead Gas-Works, of which he is the Engineer and Manager.

The party of about ninety were conducted round the works by the Engineer, the Chairman (Mr. Luke Lees, J.P.), and Messrs. King, Smith, Attwood, Owen, and Wright, who acted as guides.

DESCRIPTION OF WORKS.

The undertaking was established by a private Company in 1841, and was acquired for the town in 1858. The output of gas at that time was 67 million c.ft. This has increased until it now amounts to 1200 millions. The undertaking uses approximately 80,000 tons of coal and 700,000 gallons of gas oil annually. The outstanding capital amounts to £374,253, and the price of gas at present is 3s. per 1000 c.ft The net profit for the year ended March 31 was £21,623; the gross profit being £78,806. The reserve funds stand at £84,868. An extension scheme for modernizing the works is now in progress.

Prior to the winter of last year, the gas was manufactured in vertical retorts, augmented by water gas plant and a few hand-stoked beds. The horizontal hand-stoked retort-house has been gutted, and machine-stoked horizontal retorts have been installed. This house contains fourteen beds of 8's, arranged in two tiers, stoked by "D.B." combined charger and discharger. The coal is delivered direct from railway wagons on an overhead siding into the coal breaker, and raised by twin elevators to push-plate conveyors. The coke is handled by Drake's "Ideal" transporter, and quenched on four benches, after which it is removed by telpher to the screening plant, water gas plant, or stock. This retort-house was put into full commission in June last.

The vertical retort-house consists of ten beds of Woodall-Duckham vertical retorts, arranged in two benches of five beds each. These were built in 1913, and have worked continuously. One bench is now undergoing reconstruction, being rebuilt in silica with step grates in the producers. The coal is delivered to this house from overhead sidings to the breaker, and is elevated by gravity buckets to tipping tray conveyors. The coke is delivered into skips, which are pushed out and picked up by telphers.

The gas from these houses at present goes through one water-tube condenser to the exhausters, thence through Livesey washers, tower scrubbers, rotary washers, and water-seal purifiers. The existing washers and mains are all too small for the duty required, some of the mains being of a temporary nature. The whole of this plant is therefore being replaced, and the works will be divided into two sections complete, comprising four mains, condensers, Livesey washers, rotary scrubbers, purifying houses, and station meters. This work is proceeding at present.

WATER GAS PLANT.

This consists of four machines of the "Economic" type, each of a capacity of 750,000 c.ft. per day. A separate exhauster and purifying plant deal with the gas from the relief holder.

Work is proceeding on road making and yard paving. Prior to last year no permanent roads were in existence, except immediately adjacent to the offices. These existing roads will be renewed so as to stand up to modern heavy motor traffic.

COKE SCREENING.

There are two coke-screening plants, one being of the rotary type, for the vertical retort-house, and the other of the jig type for the horizontals. The jig screens were erected in 1923, at the same time as the conversion of No. 1 retort-house. The screens are fitted with coke cutters, and give three sizes of coke and one size of breeze. The screening hoppers are fitted with bottom discharge for wagons, and with bagging shoot and platform. Storage hoppers having a capacity of 150 tons have been erected near No. 1 retort-house. These are fitted with special shoots for dealing with small coke orders.

Tar is sold direct to distillers, and ammoniacal liquor is converted into neutral sulphate. A concentrated ammonia plant will, however, be erected shortly. Water for works' purposes is supplied from a bore hole having a capacity of 10,000 gallons per hour. Fitting shops comprise tinsmiths' shops, stove cleaning shops, gasfitters' stores, and lamplighters' department. All meter repairs are dealt with, and a number of wet meters with compensating devices are made in the meter shop. A stove cleaning shop is fitted with up-to-date machinery, including burning-off oven, buffing machines, and tinning plant.

High-pressure boosting mains have been laid during the last twelve months, to improve pressures on the outlying portions of the district; the gas being compressed up to 10 lbs. per sq. in., and then distributed by Reynolds governors. In addition to this,

gas is pumped to a storage station comprising one 2½ million c.ft. spiral-guided holder at the north end of the district. Gas oil is received *ex* ship in tanks on the quay side, having a capacity of one million gallons. The oil is pumped from this station by pipe-line to the works; this plant having been installed within the last few years, owing to the heavy cost of cartage.

The gas showrooms are situated in Argyle Street.

After the tour of the works, the party adjourned to the Woodside Hotel, where tea was served, at the invitation of the Birkenhead Gas Committee.

Mr. G. H. HAYNES (Liverpool) moved a vote of thanks to the Gas Committee, Chairman, Engineer, and guides. All had enjoyed the visit, and to have an opportunity of seeing a works in course of reconstruction was a treat.

Mr. BRIGGS (Hyde) seconded, remarking that he had been particularly struck by the methods adopted to carry on the work of reconstruction and maintain gas making at the same time.

Mr. G. S. FRITH, of Runcorn (President of the Manchester District Institution of Gas Engineers), thanking the President for his invitation, said he was pleased to support the vote of thanks. He had noticed a number of ideas worth carrying away. Mr. Stone was to be congratulated on the works and the way in which he was carrying out the reconstruction of the various plant. The Corporation should be proud of their Engineer and Chairman, and of the gas-works.

Mr. LEES expressed his pleasure at being present to extend to them a hearty welcome to Birkenhead. The Corporation were going in for the finest plant obtainable, in order to secure the best results. They were very proud of their technical staff, who were all very capable men, and always anxious to carry out the behest of the Committee.

Mr. H. E. STONE then delivered the following

PRESIDENTIAL ADDRESS.

On this occasion I propose to make first a few general observations on the present position and developments of the industry, particularly from the point of view of this Association, and then to give some details of the scheme of extensions which you have witnessed in progress at the works; for I feel that perhaps some information as to the reason for the particular methods adopted may be of interest to the members.

With regard to the present position of the gas industry as suppliers of light, power, and heat, in all these fields competition is getting keener, and members of Junior Associations, who will be responsible for the industry in the near future, cannot do better than prepare themselves to meet this competition.

GAS FOR LIGHTING.

As for public lighting, gas retains its supremacy. A visit to the Amusements Park at the Wembley Exhibition is sufficient to prove this. In domestic lighting, however, the position is not so simple. The greatest obstacle, though one which is perhaps not often referred to, is the effect of gas lighting on the internal decorations of the rooms, owing to the circulation of the air obtained. In pre-war days this was a small matter, and was more than compensated for by the increased ventilation obtained. To-day, however, with the high cost of internal decoration, the matter is one of considerable importance to the householder, and has from my personal experience been the determining factor in many cases. It is not easy to suggest a way of directly overcoming this difficulty. Domestic lighting will only be retained if free maintenance and good service are available. Unfortunately, in the case of municipal undertakings, free maintenance is difficult to secure, as gas committees do not always consider services rendered, but look chiefly at the price at which gas is sold.

GAS FOR HEATING, COOKING, AND POWER.

Gas for heating and cooking purposes is still easily predominant, but there is a large field for hot-water appliances, which requires more attention. The present high cost of apparatus and fixing is, however, an obstacle in the development of this field. The consumer in many instances is not prepared to pay a sum of £15 or more for an installation; and owing to the short life of some of the appliances, good simple-hire or hire purchase terms cannot always be arranged. If hot-water apparatus could be supplied on something like the same terms as present-day gas cookers, a large increase in output would undoubtedly follow; every house, large and small, enjoying the convenience of an ever-ready hot-water supply.

Gas for power is meeting with severe competition, and it is necessary to prove conclusively its superiority financially for this purpose.

PRESENT AND FUTURE DEVELOPMENTS.

Of late years development in the industry has been taking two forms. During and after the war, a great deal was said about the production of cheap low-grade gas, and at present further developments in this direction are proceeding by means of total gasification plants. On the other hand, advances are being made in the production of smokeless solid fuel. In this case the main product is solid fuel; gas and tar being bye-products. This situation arose in a modified form recently when exceptionally good prices were obtained for coke, so that it became almost possible to carbonize coal for the value of the coke produced.

It is very difficult to estimate which of these lines of development is likely to prove the permanent one; both may progress together. Undoubtedly, however, the time is not far distant when restrictions will be applied to prevent the pollution of the atmosphere by smoke from the incomplete combustion of fuel. Gaseous fuel is a satisfactory solution of the problem in many instances. For some purposes, however, solid fuel must be supplied under present conditions. It is highly probable that there will always be a demand for solid fuel; and the gas industry is peculiarly well fitted to supply this demand, at the same time providing gaseous fuel as a bye-product The possibilities of the subject are very great, and the amount of work done on this problem at present is little. The question is therefore one to which members of the Junior Associations could with advantage give considerable thought, as it is essential that, when the time comes, the gas industry should be in a position to meet the demand, and to take advantage of it.

BIRKENHEAD GAS DEPARTMENT'S EXTENSION SCHEME.

The Birkenhead Gas Undertaking supplies a large area, the population being approximately 175,000. The total length of main is 160 miles, and the output of gas approximately 1200 million c.ft. Until early in 1922, gas was supplied from vertical retorts which had been put into operation in 1913, and had worked continuously throughout the war. During the winter season this supply was augmented by water gas plant and a few beds of hand-stoked retorts. The outlook for the winter of 1923 was rather serious, as the vertical retort plant was in a deplorable condition, and the hand-stoked retorts in the horizontal house had not been repaired, in some cases, for twenty years. It was essential, therefore, that new carbonizing plant should be installed without delay. The choice lay between the erection of a further vertical retort plant, or use of the existing hand-stoked horizontal house. This building was in excellent condition, and was very little behind modern practice as regards the arrangements of the stages and proximity to the railway. The house was wide, and left ample room for mechanical stoking. In view of the fact that a considerable amount of water gas plant was in operation, it was decided that horizontal retorts would be the most suitable and economical.

Plans and specifications were therefore prepared with the utmost dispatch, and contracts were let in January, 1923, covering retort settings, stoking machinery, coal-handling plant, electrical plant, and screening and telpher plant. The work was divided into sections, each being let to a different contractor. This arrangement involved greater labour in preparing specifications, &c., but proved very satisfactory in expediting the progress of the work. The existing floors were strengthened by cast-iron columns, in order to take stoking machinery, and side discharge of coke was arranged for, as it was not desirable to erect telpher plant at a lower level than the existing vertical retort house track. An extension of the existing track was therefore installed outside the retort-house. Coke conveyors were not considered desirable, owing to the conditions of the site. The existing hand-stoked settings were removed, only the chimneys being retained. Difficulties were experienced with the arrangement of the telpher track, owing to the congested nature of the gas-works site; but these were overcome by the use of switches and the design of the supporting structure. The track was also continued to the water gas station. It had previously been the custom to cart coke to this—an arrangement which proved very expensive in operation—and a saving of £1500 to £2000 a year was effected by the new system. The screening plant was arranged with a coke cutter before the screens. This has proved highly successful and produces suitable coke for domestic use.

Electric power plant was a matter which required careful consideration. The existing plant consisted of two 50-KW. sets, gas-engine driven, producing current at a voltage of 230 D.C. It was decided to take a supply from the Corporation power station, as this was offered on very good terms. Consideration was also given to the fact that the Electricity Department used the gas-works output of breeze as a fuel for steam raising. I was anxious that all supplies of current should be at the same voltage, and that it should be possible to interchange the source of power in case of breakdown. A sub-station on the latest practice was therefore constructed, receiving alternating current at 6600 volts. It contained a transformer and a rotary converter, converting this voltage to 230 D.C. A new switch-board was carefully designed in order to make the three sources of power interchangeable. This was readily accomplished by the use of double bus-bars and change-over switches. It is now possible to connect any portion of the works plant to any of the three sources of electric power; and this has proved invaluable at times. A large portion of the switch-board work and the whole of the wiring and cabling were done by the Gas Department with direct labour, to their own specification. I wish particularly to emphasize this point, as, from previous experience, wiring done by contractors often proves far from satisfactory, and in the course of time is a constant source of trouble. After considerable experience I have decided that lead-covered cable, braided and compounded, is the most suitable for withstanding the atmosphere of gas-works; lead covering alone not being sufficiently durable. While on this subject I would particularly recommend members to obtain a knowledge of electrical engineering, the importance of which is increasing with the greater use which is being made of electrical plant in gas-works. It is most desirable that a gas engineer should be able to undertake all his own electrical engineering work, including the preparation of specifications, cabling, wiring, &c.

The first section of six beds was put to work in November—

eight months after the letting of the contract, and just in time to assist in meeting the peak load which occurs about this period. The next section of four beds was put into commission immediately afterwards. The existing condensing, scrubbing, and purifying plant and works mains were old, and too small for present requirements. Only the fact that they were well over requirements when first installed, some thirty years ago, had enabled the undertaking to carry on so long without renewal. It was decided, therefore, to divide the works into two sections, horizontal and vertical, by the erection of two sets of condensers and scrubbers, and the addition of a further set of purifiers. These sections will be coupled-up to independent mains; and it will therefore be possible in the near future to make interesting comparisons of vertical and horizontal carbonization, more particularly as the vertical retort plant is now being reconstructed in silica.

Mr. R. G. LEYTHAM (Lancaster) moved, and Mr. BYROM (Stalybridge) seconded, a vote of thanks to the President for his address.

MACHINERY FOR MAIN LAYING WORK.

Mr. Henry Fink, Superintendent of Distribution of the Detroit City Gas Company, in a contribution to the proceedings at the recent annual convention of the Michigan Gas Association, said that experience with power equipment in laying mains is not new to his Company, and for the last eight years various machines used in this way have been found very economical. Therefore when, at the beginning of this year, an unusually large programme of work came up, involving 125 miles of mains and 20,000 service connections, it was decided to employ machinery on a much larger scale than heretofore. Between April 1 and Sept. 1, 80 miles of mains of all sizes from 4-in. to 24-in., and 12,000 service pipes had been laid. The average number of men employed daily had not exceeded 820. Throughout the work the average performance per week has been 22,675 ft. of mains, and 480 service pipe connections. On one day when 902 men were employed 6301 ft. of mains and 118 service pipes were laid. On the work, fully 65 p.ct. of the trenching and back-filling was done by machine. All the excavations for regulator vaults, &c., the trenching for 16-in. and 24-in. mains in places inaccessible to the regular machines, and the clearing-out of "cave-ins," were dealt with by crane and "clam shell," and cranes were employed for the handling of all large pipe. There were pneumatic tools for breaking pavements, tunnelling under side walks, digging in hard clay, and caulking lead on combination joints on 24-in. mains. In addition to this, a number of small power-driven units were utilized—such as ditch pumps, concrete mixers, &c. The trenchers are the most useful of any of the equipment, and next to them come the back-fillers. The trenchers are of the wheel type. A greater amount of work is done with them, and they replace more labour and save more time and money than any other machines. Under favourable conditions a back-filling machine can deal with from 2000 to 2200 ft. of trench a day, and replace forty or fifty men. Those at present in operation are of the full caterpillar, swing boom type, and weigh 15,000 lbs. apiece—the last named being an important point. After experience with lighter machines, it has been found that with the heavier ones back-filling costs are reduced.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Activated Carbon and Silica Gel.

SIR,—In your issue of Sept. 24, you published a letter from Prof. Vivian F. Gloag, of Messrs. Simon-Carves, Ltd., of Mount Street, Manchester, referring to an extract from a paper read by Dr. Edouard Urbain, at the Centenary Congress of the Société Technique du Gaz, on activated carbon and silica gel.

Being well acquainted with the considerable work, both theoretical and practical, which Dr. E. Urbain has achieved in his laboratories, at the Experimental Station of the Paris Gas Company, and at the benzole recovery plant of the Grenoble Gas-Works, on activated carbon and on its industrial applications, I feel it only fair to him not to let the statements contained in that letter go unchallenged.

Prof. Gloag cannot, I think, be fully acquainted with the facts concerning the Grenoble plant, or with the circumstances which led Dr. E. Urbain to devote to it much time and work, and to authorize on that plant the use of his highly active carbon and of various devices which were covered by his prior patents—such as the indirect heating of the absorbing agent, the passing of the gases (before they enter the adsorption apparatus) through a preliminary absorber in order to retain the disturbing impurities, and, later on, the extraction of the saturated carbon under vacuum.

I shall take as an example Prof. Gloag's statement that the Grenoble preliminary absorber is filled with Bayer "pre-filter carbon," whereas I have authority to state that no such carbon has ever been received at the Grenoble works.

I wish also to refer specially to the visit to Grenoble, mentioned in Prof. Gloag's letter, of two independent experts from this country, as I happen to know the circumstances of that visit, having personally made all arrangements in connection with it. I may say very emphatically that I cannot see how verification of the kind suggested by Prof. Gloag could possibly have been made during that visit, and that its sole object was a thorough technical investigation of the active carbon debenzolizing process. I may add that, in the course of that visit, comparative tests were carried out between the Urbain and the Bayer carbons, and that the results obtained showed the distinct superiority of the former.

Further, I have been informed that the reports of these experts have been treated as confidential, so that I really fail to see where Prof. Gloag obtained his information as to their investigations.

Any further discussion of Prof. Gloag's letter would be of no purpose in view of the fact, which I am authorized to state on behalf of Dr. E. Urbain, that he had, out of courtesy, communicated his paper prior to its publication to one of the Managing Directors of the French firm (Société Anonyme pour l'Utilisation des Combustibles, of Paris) to which Prof. Gloag refers in his letter, and which supplies the material of the Grenoble plant, and that its wording was entirely approved.

A. ST. JOHN COOKE.

729-730, *Salisbury House, London Wall, E.C. 2, Oct. 13, 1924.*

REGISTER OF PATENTS.

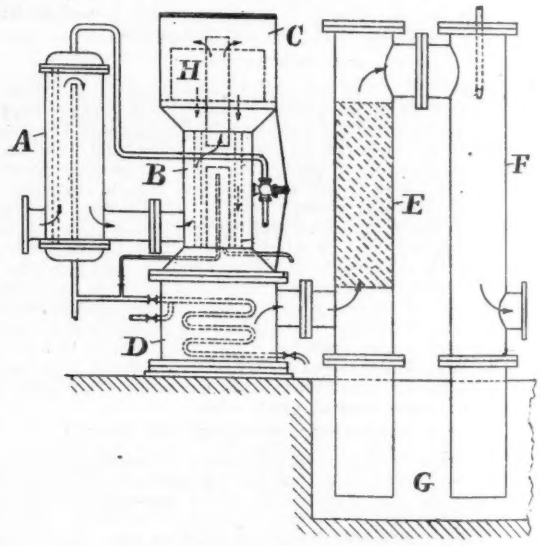
Purification—No. 221,250.

HOLMES, W. C., & Co., LTD., of Huddersfield, and COX, K., of Putney, S.W.

No. 12,403; May 9, 1923.

This invention relates to apparatus for carrying out the system of gas purification described in patent No. 185,780 [see "JOURNAL," Vol. 160, p. 377]; and the object is to simplify the working of the process, to ensure a uniform product, and to provide apparatus of a compact and simple character, occupying a minimum of floor space, and in which the reaction material may be renewed with a minimum of interference with the connections between the several parts.

According to the invention, the reaction material and the heat-exchanging surfaces embedded therein are contained in a detachable receptacle which is adapted to be inserted in, and removed from, a reaction chamber connected to a heat exchanger without interfering with the gas connections. The reaction chamber, the heat exchanger, and a condenser are preferably arranged to form a single structure; the heat exchanger being carried by the condenser and serving to support the reaction chamber.



The Cox Purifier—W. C. Holmes & Co.

A preheater may be provided, in which case it is so arranged that the supply of heating medium thereto is controlled in accordance with the variation of temperature of the gases in the heat exchanger, the heat exchanging surfaces in the exchanger, and the consequent variation in length of the latter. Oil is preferably used as the attemperating medium for the reaction material; and the oil is circulated through a heater and a cooler. The supply of heating medium to the former is controlled by a thermostat.

The invention also comprises certain improvements in the details of construction of the several parts. These are fully described and illustrated in the specification; and the broad description of the passage of the gas through the plant, a diagram of which is reproduced, must suffice here.

A is the preheater, which is fitted with any suitable heat-transmitting surfaces—say, a series of vertical tubes expended into plates. Steam is supplied to these tubes through a thermostatic valve, and passes from top to bottom; the water of condensation being drained away. The gas to be treated is caused by a baffle plate to flow the entire length of the preheater, whence it passes to the heat exchanger B. The heat exchanger is fitted with a series of tubes expanded in upper and lower tube plates; and the gas after flowing round the tubes passes through a pipe fitted to a central opening in the upper tube plate into the upper portion of the reaction chamber C, in which is

located the removal receptacle carrying the bed of reaction material H, through which the gas passes in a downward direction. Heat transmitting surfaces, in the form of oil pipes supplied by a pump, a heater, a cooler, and a thermostat, are embedded in the reaction material; and the temperature of the latter is regulated by the oil circulated.

The gas next passes through the tubes in the heat exchanger B, so that the incoming gas passing round the outside of these tubes is heated by the outgoing gas.

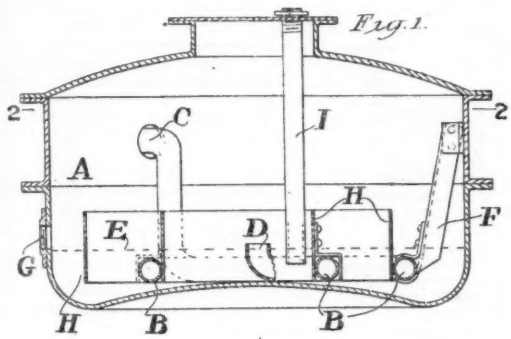
The lower part of the heat exchanger B contains a steam drum. After passing through B, the gases enter the sulphur condenser D, which is fitted with a coil supplied with steam or hot condensation water, or with cold water. Thence the gas enters a suitable cooler consisting of a vertical tower E connected at its upper end to a second vertical tower F. The lower open ends of the towers E and F are closed by a water seal G in the usual way. The tower E is fitted with a brickwork filling, and the tower F is fitted with a water supply pipe terminating in a Körting or like jet adapted to give a finely divided water spray.

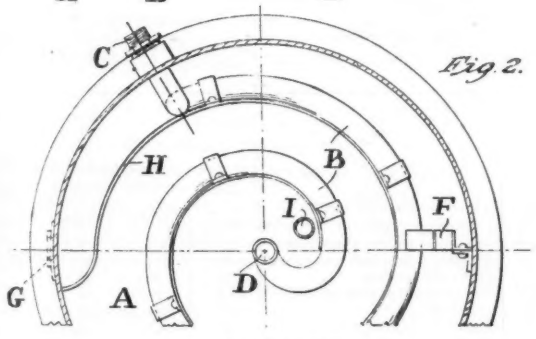
Dehydration and Distillation of Tars or Oil s
No. 221,528.

THERMAL INDUSTRIAL AND CHEMICAL (T.I.C.) RESEARCH CO., LTD., and RIDER, D., both of Grosvenor Gardens, S.W. 1.

No. 9779; April 10, 1923.

This invention refers to the known quick process of dehydrating and distilling tars or oils by passing the liquid to be treated through pipes or containers immersed in a bath of molten metal, in which the liquid is in contact with the whole of the inner service of the pipe or container and is therefore heated on all sides, and is directed to avoid the disadvantage arising from the absence of a definite vapour space which leads to over-heating of the liquid and consequent cracking and deposition of the carbon. It is sought to avoid this disadvantage by controlling the temperature of the molten metal or alloy so that it exceeds by a few degrees only the boiling point of the highest boiling distillate which it is desired to obtain. For instance, in the case of the dehydration of tar or the distillation from it of lighter fractions, this excess





A "T.I.C." Still.

of temperature would be in the neighbourhood of 10° to 15° C.; but when heavier fractions are being distilled the difference of temperature would be greater. Since the liquid coming into contact with the inner walls of the pipes is never subjected to an excessive temperature, overheating or cracking of the liquid or distillates and the consequent deposition of carbon on the walls is minimized, and the pipes remain substantially clean, so that the transmission of heat is maintained. The life of the pipes or containers is prolonged.

The accompanying drawings illustrate a suitable apparatus; fig. 1 being a vertical section, and fig. 2 a part-horizontal section on line 2—2 of fig. 1.

The still A contains a spiral pipe B of which the admission end C extends through the wall of the still, while the delivery end D is upwardly turned so that it protrudes above the surface E of the molten metal or alloy, the greater part of the pipe being submerged beneath the surface. The pipe is supported by two struts F from the wall on the still. The tar or oil is heated as it flows through the spiral pipe, and such portion as is not vapourized therein flows from the open end D on to the surface of the metal or alloy. Here it travels in the form of a thin layer towards the outlet G; its path being protracted by a spiral plate H supported on the pipe so that a part of it is immersed in the molten metal. Matter which will not volatilize at the temperature of the metal leaves the still by the outlet G.

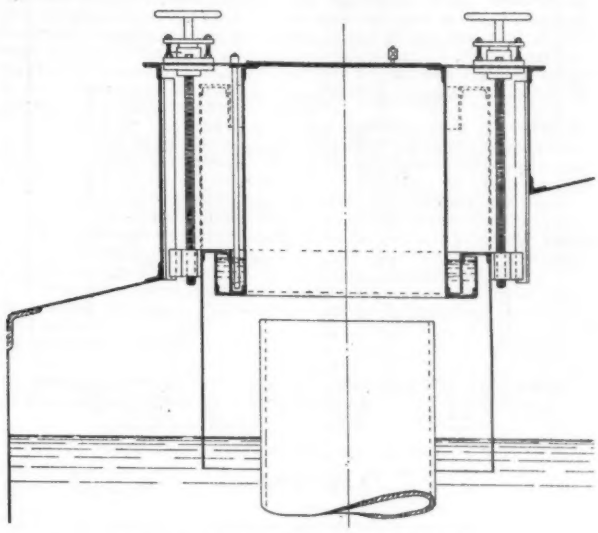
The tube I contains any known thermostatic device for keeping the temperature at the desired degree, or a pyrometric device.

Access to Gasholder Pipes.—No. 221,610.

FALL, F. P., of Sunderland, and ASHMORE, BENSON, PEASE, & CO., LTD., of Stockton-on-Tees.

No. 18,347; July 16, 1923.

The object of this invention is to provide means for enabling a man to enter the inlet and outlet pipes of a gasholder when the holder is at rest and the crown full of gas, or to seal the pipes for a man to enter the holder when at rest, if repairs are required.



Access to Inlet or Outlet Pipe of a Holder.

A hood, which may be cylindrical or of other shape, is provided, which is adapted to be lowered, by screws or otherwise, in such a manner that when the gasholder is at rest and in its lowest position the hood surrounds the upturned end of the inlet or outlet pipe and dips below the water level to a sufficient extent to preclude the escape of gas from the crown of the holder into the pipe. The hood is adapted to be water-sealed, when in its lowest position, to a rise at the top of which is a manlid. Means may be provided whereby the water necessary for this sealing can be introduced or withdrawn from outside; for steadying the hood and keeping it vertical; and for ascertaining that there is no pressure in the outlet pipe when the seal has been made.

One form of the invention will be clearly understood from the sectional elevation which we reproduce.

Manufacture of Carburetted Water Gas.
No. 221,622.

HUMPHREYS & GLASGOW, LTD., of Victoria Street, S.W. 1.

A communication from EVANS, O. B., of Philadelphia (Penn.), PERRY, J. A., of Swarthmore (Penn.), and EICHENGREEN, L. B., of Ardmore (Penn.).

No. 19,974; Aug. 3, 1923.

The patentees point out that in the manufacture of carburetted water gas it has at the present time become necessary to use heavy oils or residuums with a coke of (say) 15 p.ct. These heavy oils cannot be successfully used by simple methods because, if introduced directly upon the top of a fuel bed blasted from the bottom, they and their residue interfere with the fire, sometimes even extinguishing it, and if introduced into the carburettor their residue is so large that it chokes the brickwork and causes ash and carbon to collect therein.

The present invention has reference to the gasifying of such heavy oils and residuums in the manufacture of carburetted water gas by an improved process of the kind in which secondary or supplemental air admitted during the ordinary blowing of the producer serves to raise by combustion that portion of the mass of fuel against which the heavy oil is introduced.

Accordingly, the upper portion of the fuel bed is marginally blasted with secondary air, thus wholly or partially consuming the producer gas generated at the bottom of the generator fire by the primary blast, and providing an incandescent or relatively hot zone of ring form at the top of the fuel bed; and the heavy oil is introduced on to the top of this hot ring zone (preferably in spots) during the run. Thereby the heavy oil is gasified during runs, in part by reason of the high heat of the zone and in part by reason of the flow of hot water gas through it; and thereby the heavier part or pitch of the oil remains deposited on the top of the fuel and is partially coked, during the run period, and fully coked and consumed during the succeeding blows which may pass between the spots. As the oil is gasified at the top of the fuel bed, the oil gas does not pass through a depth of fuel which might result in more or less decomposition of the oil gas.

Hotplates.—No. 221,721.

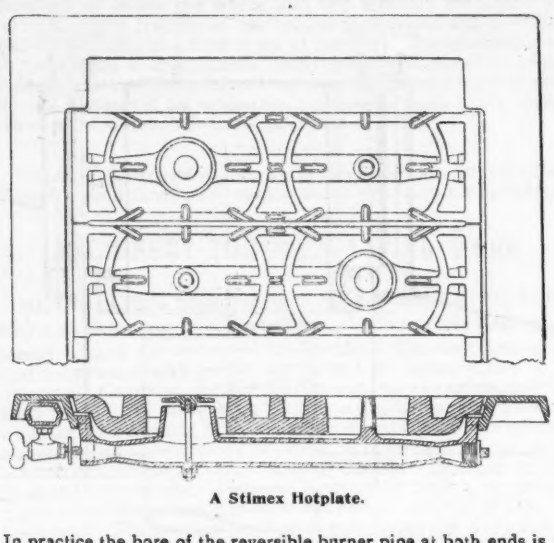
NEW STIMEX GAS STOVE CO., Ltd., of Balham Hill, S.W. 12, STIMSON, E. F., of Tooting Bec Common, S.W. 17, and DIXON, L., of Balham Hill, S.W. 17,

No. 1263; Jan. 16, 1924.

This invention relates to the hotplates of gas cooking stoves, and its object is to enable a hotplate to be built up of a plurality of a minimum

number of different elements, such that by a mere reversal of a particular element the situation of a burner can be changed.

The hotplate has longitudinal parallel burner pipes supported at their ends; and for the above purpose each burner pipe is provided with a burner orifice situated on one side of the mid-length of the pipe, and either end of the pipe can serve as the inlet by being placed opposite a gas nozzle, the other end being removably plugged, in conjunction with a superposed grid of a configuration permitting reversal of the burner pipes.



A Stimex Hotplate.

In practice the bore of the reversible burner pipe at both ends is of venturi section, and, preferably, the burner itself is an enlargement of the pipe formed with a wide circular upwardly directed aperture partially closed by a mushroom disc adjustable on an upright central screw stud, so that the gas mixture issues through an annular lateral slit. Alternatively, the burner pipe may be enlarged as a ring with holes through which the mixture issues.

We give a part-plan and a longitudinal section of the hotplate.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Oct. 8.]

Nos. 22,870 to 23,506.

Brown, P. A.—"Retorts for dry distillation of oils, tars, &c." No. 23,358.

Cliff, A.—"Furnaces, &c." No. 23,404.

Eclipse Copper Company.—"Automatic gas and water control for geysers, &c." No. 23,367.

Fleming, F.—"Incandescent gas burners." No. 23,025.

Galley, W. G.—"Valves for controlling flow of streams of fluid." No. 23,450.

Gas Meter Company, Ltd.—"Dry gas meters." No. 23,389.

Green, W. A.—"Frames of gas-lighting burners, &c." No. 23,468.

Greenfield, J.—See Gas Meter Company, Ltd. No. 23,389.

Heller, O.—"Utilizing heat produced in quenching coke." No. 23,412.

Helps, G.—"Gas burners and cookers." No. 23,459.

Heyl, G. E.—"Distillation of oil shale, coal, &c." No. 22,910.

Kidd, F.—"Determining impurities in gases." No. 23,418.

Lane, H. R.—See Galley, W. G. No. 23,450.

Markes & Co., Ltd., W.—See Galley, W. G. No. 23,450.

Midgley, C.—See Eclipse Copper Company. No. 23,367.

Mitchell, J.—"External heating of vertical gas retorts." No 23,158.

Nicklin, M. E.—"Manufacture of ammonium sulphate and other salts." No. 23,161.

Pique, J. J.—See Kidd, F. No. 23,418.

Rothwell, H. & J. C.—"Means for sealing holes in gasholders, &c." No. 22,892.

Silverlock, H.—"Geysers, &c." No. 22,938.

Smith, A. J.—See Kidd, F. No. 23,418.

Wickham, O.—"Distribution devices for controlling flow of liquids in pipes." No. 23,414.

Williamson Cliff, Ltd.—See Cliff, A. No. 23,404.

Winser, C. B.—See Brown, P. A. No. 23,358.

Southport Corporation Tour the Gas Estate.—Acting on a suggestion of the Mayor of Southport (Alderman C. Aveling, J.P.), the members of the Town Council and other officials visited and inspected the gas-works on Thursday afternoon. At the conclusion of the tour tea was served, and Alderman E. Trounson, J.P. (Chairman of the Gas Committee), extended a welcome to the Town Council. He gave some interesting figures in relation to the undertaking. Up to date their capital expenditure had been £333,000, and the outstanding capital at present was £111,000. In addition they had handed-over for the relief of the rates £265,000 This policy had been discontinued. Dealing with the growth of the estate, Alderman Trounson said that in 1895 the output of gas was 334,000,000 c.ft., and in 1924 662,000,000 c.ft. The number of daily consumers was 20,000, and the rate of increase to-day was greater than in pre-war days. Last year the increase was 6 p ct., and this year there was an increase of 8 p.ct. He said they were proud of Mr. Bond, their Engineer, and his staff.

MISCELLANEOUS NEWS.

CITY AND GUILDS OF LONDON EXAMINATIONS.

Reports of the Examiners in Gas Supply and Gasfitting

In forwarding at the request of the authorities the following reports of the respective Examiners in Gas Supply and Gasfitting on the recent examinations of the City and Guilds of London Institute, Mr. Walter T. Dunn (the Secretary of the Institution of Gas Engineers) adds that he is to say that the question of a grouped course in Gasfitting, and the regulations governing examinations, are now under consideration by the Sub Committee of the Advisory Committee on Education of the Institution. Until this Sub-Committee have presented their recommendations to the Advisory Committee, and the Committee have considered them, no definite action in this matter will be taken.

The questions set will be found in the issues of the "Journal" for May 14 (p. 480) and May 21 (p. 547).

GAS SUPPLY.

Examiner, Mr. H. Kendrick.

The marking of the candidates' work at the 1924 examination has resulted as follows:

	First Class Pass.	Second Class Pass.	Failures.	Total Papers.
Grade I.	3	3	2	8
Final Grade	22	66	100	188
	25	69	102	196

The analyses of the answers and questions are:

Grade I.

Question.	Subject.	Answers			
		First Class.	Second Class.	Failures.	Total.
1a	District pressures	2	2	0	4
1b	Main joints	3	1	0	4
2a	Leakage detector	2	0	0	2
2b	Service pipes	3	1	0	4
3a	Main deposits	3	0	1	4
3b	Main branching	2	3	0	5
4a	Wet meters	3	1	1	5
4b	Dry meters	2	0	1	3
5	Alloys and jointing	3	1	0	4
6	Ventilation	4	1	1	6
7	Maintenance of burners	3	1	2	6
8	Mantle breakages	3	0	4	7
9	Lamps	0	1	1	2
10a	Gas engines	3	0	1	4
10b	Gas fires	0	1	2	3
11	Cottage water heater	0	0	0	0
		36	13	14	63

Final Grade.

Question.	Subject.	Answers.			
		First Class.	Second Class.	Failures.	Total.
1a	Undedicated road	10	15	23	48
1b	Joint efficiencies	34	24	43	101
2a	Duties on breaking-up roads	35	43	14	92
2b	Gas fires	37	33	43	113
3a	Lacquering stoves	27	17	12	56
3b	Rivet heaters	5	3	9	17
4a	Main capacities	58	11	16	85
4b	Shop window lighting	71	20	1	92
5a	Spun pipes	17	28	16	61
5b	Change-giving p.p. meters	6	4	5	15
6a	Therms and B.Th.U.	141	22	12	175
6b	Street lighting	9	7	11	27
7	Gas fire flues	41	24	19	84
8	H.P. district governors	32	25	37	94
9	Garage heating	9	6	11	26
10	Meter construction	14	19	49	82
11	Suction and gas engines	28	34	24	86
		574	335	345	1254

The average number of questions answered by candidates in Grade I. is 7·9, and in Final Grade 6·7.

The few papers written in Grade I. show a very considerable improvement on the previous year's work, and generally they had been well grounded in their work. A slight improvement in the three second class would have warranted a first-class pass; while the two failures obtained nearly 40 p.ct. of the total marks. The candidate awarded the prize gave an exceedingly good paper; he obtained 82 p.ct.

In the Final Grade, the work of the candidates showed a very considerable falling-off, and it is quite evident that many of the candidates were very badly prepared. Particularly is this the case in one group, where are 73 entries. The passes and failures of this group emphasize this statement, as those in the remainder are quite up to recent aver-

ages, and the standard of work and preparation has been very much higher, as shown by the following table:

	GROUP OF 73.			REMAINDER.	
First class passes	2	2·7 p.ct.		20	17·5 p.ct.
Second ,, ,,	24	32·9 ,,		42	36·5 ,,
Failures	47	64·4 ,,		53	46·0 ,,
	73			115	

The standard of general knowledge revealed by the papers was high among those that obtained a pass, but much worse among the others:

FINAL GRADE.

5	Candidates obtaining	less than 20 p.ct.	of the total marks.	
26	,, ,,	between 20 and 30 p.ct.	,, ,,	,,
38	,, ,,	,, 30 and 40	,, ,,	,,
32	,, ,,	,, 40 and 50	,, ,,	,,
55	,, ,,	,, 50 and 60	,, ,,	,,
11	,, ,,	,, 60 and 65	,, ,,	,,
17	,, ,,	,, 66 and 73	,, ,,	,,
5	,, ,,	over 73 p.ct.		

and of the latter one is credited with nearly 80 p.ct.

Last year only 2 candidates obtained less than 30 p.ct. against no less than 31 this year.

As last year, many candidates failed to read the questions carefully, and could have gained many more marks had they answered the whole of the question—most of these omitting the explanations and reasons asked for, and even the second half of the questions entirely. This applies particularly to questions 1*a* and 1*b*, 2*a*, 3*b*, 8, 9, 10, and 11 With fuller replies the number of first and second class replies should have been considerably greater. The 17 papers with over 66 p.ct. of marks were very good, and the 5 with over 73 p.ct. were excellent, particularly the one with 80 p.ct.

The sketching of a few candidates was excellent, but the remainder either omitted sketches altogether or made them so badly that it was impossible in some cases to judge of the knowledge of details which is necessary to secure the marks for a first class in an Honours Grade. More practice is required by students in class and home work, and in a course drawing and sketching should be included.

The Final Grade paper was a continuation of the experiment tried last year, with the view of suggesting the sub-division of the Final Grade examination into a course for administrators and for inspectors only. Unfortunately, very few of the higher officials in the distribution department, or those aspiring for these posts, appeared to have sat for the examination this year, preferring probably to take the Institution of Gas Engineers' new course in this subject.

The answers in the various papers show distinctly that the majority of the candidates answered those questions which would only entitle them to be an inspector, sales manager, or superintendent of a small undertaking.

I am of opinion that extracts from my report, including the tables, should be sent to the teachers, so that they may pay special attention to those subjects in which the students have shown themselves deficient.

GASFITTING.

Chief Examiner, Mr. R. J ROGERS.

The examinations in gasfitting this year consisted of a Grade II. and Final Examination.

GRADE II.

79 candidates, as compared with 98 in 1923 and 79 in 1922.

The test consisted of (*a*) a written examination held on May 5 from 7 to 10 p.m., and (*b*) a practical test on May 17 from 2.30 to 6.30 p.m.

Results.

Passes	50	62·3 p.ct.
Failures	29	36·7 ,,

FINAL EXAMINATION.

In this grade 19 candidates were examined, as compared with 39 in 1923, 48 in 1922, and 83 in 1921.

The examination comprised (*a*) a written examination held on May 5 from 7 to 10 p.m., (*b*) a *viva voce* examination on May 17 from 11 a.m. to 1.0 p.m., (*c*) a practical workshop test on May 17 from 2.30 to 6 30 p.m., and (*d*) an inspection of candidates' work on the district on May 16.

Results.

First class passes	13	68·42 p.ct.
Second ,, ,,	2	10·53 ,,
Failures	4	21·05 ,,

GRADE II.

Observations on Viva Voce and Practical Examinations based upon Reports of the Local Examiners.

Grade II. students showed a lack of knowledge in the following subjects: Consumptions of various appliances, candle power of burners, principle of a gas engine, working and operating of pressure recorders, radiant efficiency of a gas fire, and thermostats.

The answers of many students to the *viva voce* questions were disappointing, and in several instances showed lack of knowledge. The mechanism and action of meters was not understood. More practice is required in the working-up of compo pipe. It would appear that more attention should be given to theoretical aspects, and students should be impressed with the value of such knowledge.

Some Local Examiners expressed the view that Grade II. certificates should not be granted to students under 18 years of age; one examiner being of opinion that a certificate should not be granted to anyone who has not had at least two years on the district. The conditions of entry to the gasfitting examinations, and the qualifications of the candidates, were fully discussed at a conference of Local Examiners held at the offices of the Department of Technology in August, 1922, a report of which conference was forwarded at the time to the Secretary of the Institution of Gas Engineers and the Superintendent of the Department of Technology, City and Guilds of London Institute. If the existing conditions of entry are to remain, it would certainly appear to be desirable that some further course of study and certification should be arranged to occupy the candidate's attention until such time as he is qualified to sit for his Final Certificate in gasfitting.

Observations on the Written Examinations.

The knowledge displayed by the Grade II. students in their written papers this year was disappointing, and points to the need for greater attention to be paid to the theoretical instruction of the candidates. It will be noted that this deficiency was observed by the Local Examiners in the *viva voce* test. It may again be emphasized here that, in addition to improvement in the craftsmanship of the fitter, it is also very desirable that he should possess a fair knowledge of the construction and performance of the apparatus he is called upon to fix. With the increasing number of types of appliances now in use, the need of this knowledge is becoming of greater importance; and if the utmost service is to be rendered to the gas consumer by gasfitters, those in charge of gas undertakings should pay more attention to the education of the gasfitter than they have done hitherto.

It is apparent from the examination of the papers submitted by Grade II. candidates that many of them were unfitted to take the examination, and the Institute's examiner considers it desirable that further attention should be given by the Institution of Gas Engineers and the City and Guilds of London Institute to the preparation of a suitable syllabus and course of instruction for junior gasfitters, and that consideration should be given to the suggestions of several Local Examiners referred to in the earlier part of this report, as to the qualification and age of candidates for the Grade II. examinations.

Several gas undertakings have schemes of education in operation for the training of gasfitting apprentices, and award their own certificates and prizes. The Examiner suggests that it would be of assistance to gas engineers generally if a scheme of education could be prepared by the Institution which could be issued as a model for gas undertakings to adopt, in order that junior gasfitters may obtain efficient preparation for the examinations of the City and Guilds of London Institute.

FINAL EXAMINATION.

The few candidates who submitted themselves for the Final Examination this year were of a much higher standard than usual, and I think it may be taken that the form of examination is of a sufficiently high standard to test the ability of the candidate, and that those gasfitters who are able to qualify for a first-class pass may be considered capable and efficient workmen.

The examination of candidates' work on the district, which was instituted in 1923, was carried out this year quite satisfactorily, and the holding of the *viva voce* test in the morning of the day on which the practical examination is held has proved to be a great advantage to the Local Examiners, as they are enabled by the extra time available to test the candidate thoroughly with the questions placed in the *viva voce* test paper, and with such supplementary questions as they think fit.

It is most disappointing to those interested in the advancement of gasfitters' education, and extremely regrettable from many points of view, that so few gasfitters present themselves for the Final Examination. Out of the whole of the gasfitters employed in the British gas industry, only nineteen submitted themselves for examination this year, and it is obvious that unless candidates enter for the examinations in larger numbers in the future, the time and expense involved in the preparation and carrying out of the examinations cannot very well be justified. In the opinion of the Examiner, greater inducement must be given by the administrators of the gas undertakings to the improvement of the knowledge and craftsmanship of the gasfitter, and some financial reward should be made to those fitters who give their attention and study to the various subjects, and who ultimately pass the Final Examination. In some undertakings it is already the practice to reward successful candidates by granting an advance of 2s. a week in their wages. From the personal experience of the Institute's Examiner, he is satisfied that any expense incurred by gas undertakings in this work would be repaid many times to the undertaking in the better work and service rendered to the gas consumers.

The Examiner reiterates his opinion that all gas undertakings should be urged by the Institution of Gas Engineers to encourage their fitters to enter for the examinations, to arrange with the local Technical School authorities for facilities to be provided for holding weekly classes, and to offer some financial inducement to those gasfitters who pass the Final Examination.

GAS REGULATION ACT APPLICATIONS.

There has appeared in the "London Gazette" the following further notice regarding applications to the Board of Trade under the Gas Regulation Act.

DECLARATION OF CALORIFIC VALUE.

Penryn Gas Company, Ltd.—500 B.Th.U. (Jan. 1, 1925.)

GAS REGULATION ACT ORDERS.

We have received from the Director of Gas Administration a copy of the following further Order made by the Board of Trade under section 1 of the Gas Regulation Act.

Oakham Gas and Electricity Company, Ltd.

After the declared date (i) the standard price in respect of gas supplied by the undertakers shall be 15d per therm; (ii) "1·2d. per therm" shall be substituted for "6d. per 1000 c.ft." in sub-section (3) of section 26 (price of gas, sliding-scale) of the Oakham Gas and Electricity Act, 1923.

For the purpose of ascertaining the authorized rate of dividend, any price charged per 1000 c.ft. before the declared date shall be rendered into the equivalent price per therm by dividing it by five-and-one-half.

Prepayment meter clauses are included. (Oct. 4.)

PRICE OF GAS IN DUBLIN.

Application for an Amending Order.

Last week Mr. E. A. Swayne, K.C., held an inquiry in the City Hall, Dublin, into an application by the Dublin City Commissioners, administering civic affairs in room of the Corporation (which stands suspended under order of the Free State Government), to the Ministry of Commerce and Industry for an Amending Order reducing the powers of charging authorized by the Alliance and Dublin Consumers' Gas (Charging) Order, 1921.

CASE FOR THE APPLICANTS.

Mr. BURKE, Assistant Law Agent, stated, on behalf of the Commissioners, that before the war the Alliance and Dublin Gas Consumers' Company worked under section 16 of the Act of 1899, but as the result of an inquiry into the cost of materials and wages, the price of gas went up and the dividend went down, being ultimately reduced to £2 17s. 6d. per £100 of stock. Under a War Emergency Act, the Company were authorized to pay a dividend of £3 6s. 3d. p.ct., regardless of the price charged for gas. There was some control as to price, but, subject to this, the charge gradually increased to 7s. 6d. per 1000 c.ft. The Gas Regulation Act of 1920 provided a new basis of charge; and the new standard per therm was introduced. By an Order of September, 1921, the Company were given a standard of 1s. 7d. per therm, in substitution for an original standard price of 3s. 7d. per 1000 c.ft. Having furnished details of negotiations between the Corporation and the Gas Company on the question of reduced charges, Mr. Burke said they had now arrived at an agreement; and they asked the Inspector to recommend that it be sanctioned by the Ministry. The charge proposed was 1s. 3d., in place of 1s. 7d.

CASE FOR THE COMPANY.

Mr. LARDNER, K.C., for the Gas Company, said they recognized, as did the Corporation, that there was a heavy burden on the people. The Corporation were only concerned to bring about the earliest possible reduction of the price of gas. With the Gas Company the real trouble was that they had got an old plant, and that they had had to convert it into a new one. Dublin consumers suffered under difficulties of distribution. Three points were urged for the reduction. The Corporation, in the first place, said that the accounts included large sums for reconstruction and renewals, which were not recurring charges, and that the expenditure on these sums had the effect of advancing the price of gas. Again, it was said that the cost and the charges incidental to the production of gas were substantially altered by reason of the decreased cost of coal. And, further, there was the contention that the cost was not affected by the cost of freight. He would show that this did not affect the price of gas in any way. It was also contended that there was a decrease in wages; but, while this was so, it should be pointed out that it did not come into operation in any of the year's accounts in respect of which the inquiry was concerned. The trouble was that the number of consumers per mile of main in Dublin was smaller than in any other concern in the three countries. They had, in fact, a big area and a small community. The Gas Company were anxious not only to treat their shareholders well, but to act in the same manner towards their consumers and the public.

EVIDENCE OF MR. W. J. GREY.

Mr. *W. J. Grey* (Secretary of the Gas Company) said there were in Dublin at present 58,892 gas consumers. Since 1914 the average consumption per customer had been rising steadily. There had been decreases in the price of coal since the last inquiry—May, 1921—but it was curious that since 1923 the price of coal had risen, so that it was now 4s. a ton more than it was last year. The cost of manufacture had greatly increased, and it had been necessary at certain times of the year to use oil. To save money and give a reduction in power, they decided some years ago to close-down their works at Kingstown, Bray, and elsewhere. To enable them to have good storage accommodation, a contract had been signed for an additional gasholder at a cost of £56,000. This holder was now well on the way to completion. It was necessary to have a substantial foundation, and the contract price in that instance was £6386. There were costs for repair work, &c., amounting to £1500. A contract had been made with a Halifax firm for the supply of new apparatus at a cost of £7000. Altogether the total cost would work out at £70,000, and this sum was placed as a charge against their accounts for the whole of 1924 and the first half of 1925. In Dublin the percentage of increase from the pre-war price of gas was the third lowest of all the large undertakings in the three countries, and the distribution costs were out of all proportion.

INCREASED WAGES.

The increase in wages since pre-war days would more than account for the difference between the price of gas pre-war and the price at present. Before the war, gas was 3s. 6d. per 1000 c.ft.; now it was 4s 10½d. In the year ended June 30, 1915, the amount paid in wages was £45 208; for the year ended Dec. 31, 1923, it was £145,243. There had been in that period an increase of 100 in the number of workers. The increase in wages was equivalent to 1s. 4d. per 1000 c.ft. of gas. Belfast, in 1914, had about the same number of workers as Dublin, yet the expenditure on wages in the northern city was less than in Dublin. In Dublin the wages were 22 84d. per 1000 c.ft.; in Belfast 15·32d. Rates in Dublin cost 3d. per 1000 c.ft.; and in Belfast 0·7d. In pre-war days the stoker in Dublin got 35s. a week. In Manchester the wage was 38s. 11½d., and in London 43s. 9d. Now the wage of the Dublin stoker was 85s. 7d.; in Manchester the stoker now got 76s. 6¾d; and in London the figures were 83s. 5¾d. The increase in percentage was: Dublin, 145; Manchester, 97; London, 91. The Dublin boiler-firemen had 28s. pre-war; Manchester, 34s. 10d.; London, 36s. 7d. In Dublin now the wage was 85s. 7d.; in Manchester, 76s. 7d.; and in London, 75s. 7d.

STANDARD AND SELLING PRICES.

Mr. J. H. S. RUSSELL stated that the undertaking at the conference which led to the agreement was that the Company should have a standard price, but that the actual selling price should be 1s. 1d.

Mr. *Grey* remarked that this undertaking would be carried out.

Mr. BURKE said the standard price was to be 1s. 3d., and this was not to be increased without due notice to the Corporation or the Commissioners acting on their behalf, so that, if necessary, there should be a further revision of price.

This terminated the inquiry.

Among the parties interested who were legally represented were: The Kingstown Urban District Council, the Dalkey Urban Council, the Rathmines and Rathgar Urban District Council, the Killiney and Ballybrack Urban District Council, the Blackrock Urban Council, the Rathdown No. 1 Rural District Council, and the Dublin County Council.

ST. DUNSTAN'S NINTH ANNUAL REPORT.

The two outstanding impressions left by a perusal of the ninth annual report of St. Dunstan's, are, first, the splendidly permanent effects of the work undertaken by the organization on behalf of the Empire's war-blinded men, and, secondly, the efficiency and business-like character of the administration.

Three closely-printed pages of actual letters from the men themselves, telling of the success they have made of their lives, and their gratitude for the opportunities provided, form striking proof of the lasting effect of St. Dunstan's work and the necessity for its continuance. These letters come from practically every part of the Empire, and are written by men who have been settled in a remarkably wide range of occupations. But there is very clear evidence, on reading this detailed report of past achievement, present endeavour, and future responsibilities, that St. Dunstan's work is far from finished yet. It will probably come as a shock to many who were inclined to regard the work of St. Dunstan's as necessary only during the years of war, to learn that since the Armistice over six hundred men have been admitted to St. Dunstan's care and training, and that up to the end of the period covered by the report there were nearly eighty men undergoing, or awaiting vacancies for, training. These form an aftermath which few could have foreseen—the men who have lost their sight since the war as the direct result of their war-service. It is to be feared that this sad toll is not yet ended; and it is good to know that these post-war blinded men from the 30,850 who were discharged from the Imperial Forces with damaged sight can count upon St. Dunstan's help if, and when, the final curtain of darkness falls upon them.

A detailed statement of accounts and balance-sheet is presented in the report, and these show how vast is the character of the work undertaken by the organization. The Council, considering the trying time all charities have had to go through of late, are to be congratulated upon showing a small balance on the right side. But it is pointed out that this position has only been rendered possible by the exercise of the most rigid economy which would not impair the efficiency of the services given to the war-blinded men, and that the raising of the necessary funds has meant unremitting effort—no less than nine-tenths of the yearly income needed having to be raised by appeals to the public.

The title given to the report, "A Debt of Empire," might well stand as the strongest and truest appeal which St. Dunstan's can make to the people of the Empire for support in its work for perhaps the greatest sufferers in the world war.

TRADE NOTES.

A New Catalogue of Machinery.

Messrs. James and Frank Howard, Ltd., of Bedford, have issued a new catalogue showing a representative range of the articles they manufacture. The works of this firm at Bedford cover over 23 acres.

Main Gas Fires.

The new season's gas fire catalogue issued by Messrs. R. & A. Main, Ltd., Gothic Works, Falkirk, is an outstanding example of up-to-date publicity; the entire tone of the publication being one of refinement and charm. The firm's policy of providing none but apparatus of the highest efficiency, sound construction, and reasonable price meets with the success which it deserves; and recently further extensions have been made to the manufacturing plant. The illustrations and subject-matter throughout are of a very high standard.

Complete Gasification Plants.

Messrs. Gas and Fuel Plants, Ltd., of 40-43, Norfolk Street, Strand, W.C. 2, have recently received orders for complete gasification plants for Kilmalcolm (Scotland), and Charleville, Levery, Thizy, and St. Germain (France), the latter two being repeat orders for plants of larger capacity. The Société Anonyme des Appareils de Manutention et Fours Stein, of 48, Rue la Bcétie, Paris, are the French agents of the firm.

Electricity Scheme Opposed.—At an inquiry by inspectors of the Irish Free State Ministry of Commerce and Industry in regard to a proposed municipal electricity scheme in Clonmel (Co Tipperary), and for sanction to a loan of £13,125 for the undertaking, opposition on behalf of several ratepayers was offered by Mr. W. J. Skinner.

Oxford Gas Capital Issue.—An offer for sale by tender of £79,498 of 5 p.ct. perpetual debenture stock of the Oxford Gas Light and Coke Company is being made by Messrs. A. & W. Richards. The minimum price of tender for the stock is 95 p.ct. The stock carries interest from the 31st inst. The Company have a total authorized capital of £393,892, of which a balance of £163,835 remains unissued; while the authorized loan capital is £196 946, of which only £35,530 has been raised in the form of mortgages and debenture stock. The issue is made to provide for extensions rendered necessary by increasing demands for gas. Tenders must be forwarded to Messrs. Richards, No. 37, Walbrook, London, E.C., not later than 11 o'clock to-morrow (Thursday).

LOW-TEMPERATURE CARBONIZATION.

Criticisms of "Coal and Power."

In a letter to "The Times" this week, Lord Gainford, Chairman of the Coke Association of Great Britain, makes some interesting observations on low-temperature carbonization. Both Mr. Lloyd George and Mr. Frank Hodges, he says, have pinned their faith to low-temperature carbonization, and he adds that the authors of "Coal and Power" have been seriously misled. The following extracts from his remarks are of considerable interest.

"In 'Coal and Power' the authors say: 'The building-up of a native benzole industry depends entirely on carbonization; the economic development of a dye industry largely depends on the existence of a native benzole industry.' Now the technical investigator's comment on this is that the process advocated by Mr. Lloyd George's Committee is absolutely incapable of yielding the benzole hydrocarbons, which are the raw material of the dye industry. High-temperature carbonization, as at present practised, supplies benzole for the dye industry, and, as it happens, supplies more than that industry requires. Again, we are led to believe by Mr. Lloyd George's advisers that low-temperature carbonization is the source of our supplies of high explosives. 'Many a ton of English coal,' say these gentlemen, 'was coked by the Germans and returned to us in the form of high explosive.' But again they have gone astray; the starting point of high explosives are the benzole hydrocarbons, the entire absence of which, as bye-products yielded by low-temperature carbonization, renders this process useless in national emergency.

"We are told, yet again, that electrical power would be available for all at a cheap rate if super-stations were supplied with the semi-coke residual of low-temperature carbonization. But this low-temperature coke is a manufactured fuel, to which a cost attaches not involved in the use of raw fuel. What is the inducement for the super-stations to prefer it to raw coal? And how, if a higher price does not deter them from buying it, can they sell their electrical power at a reduced price? In another part of 'Coal and Power' we read that one of the advantages of low-temperature carbonization lies in the recovery of ammonium sulphate, well known as a valuable agricultural fertilizer. The truth is that the yield of ammonium sulphate is so negligible that the Director of the Government Fuel Research Station takes no account of it in the balance-sheets of this process published in his recent book on the subject."

"For users of gas no promises are made by the advocates of low-temperature carbonization, and this, no doubt, for the excellent reason that the gas yield from this process is but three-fifths of the yield from the high-temperature carbonization process as now practised. It is now over twenty years since this process was first brought to the notice of the public. It has been investigated, experimented upon, modified, and transformed in at least fifty varieties of ways. The highest technical skill has been exercised upon it. Laboratories have been devoted to the most elaborate researches into the possibilities of its development. Over a million pounds have been expended in an effort to give this phantom a body and a shape. And yet we find no convincing solution of the problems which surround it. The experience of foreign countries confirms our own. In America, Germany, Belgium, and France, who are our keenest industrial competitors, what do we find? They are still experimenting, it is true, in a more or less perfunctory way with low-temperature carbonization, and that largely because of our example. But large-scale developments in these countries at present are in the direction of the well-established high-temperature carbonization processes. In Germany the erection of high-temperature plants proceeds apace.

"The public can have a smokeless Britain and all the other desirable things associated with low-temperature carbonization, at a cost. Processes promising satisfactory results from a mechanical and engineering point of view already exist; but not one of them can work unless the public are prepared to pay more for their heat, light, and energy. To promise more at the present juncture is to delude and deceive the public."

Improving Torquay Gas Supply.—In consequence of complaints from distant parts of their area of supply, the Torquay Gas Committee have decided to lay a new main. At last week's Council meeting the recommendations of the Committee were approved, and it was decided to apply to the Ministry of Health for sanction to borrow £2000, and that the Town Clerk be asked to interview the Minister of Health with a view to expediting the sanction to the loan, having regard to the urgency of improving the supply. The recommendations of the Committee were that an 18-in. pipe replace the present 12-in. pipe from the outlet of the holder to the 12-in. and 7-in. mains outside the booster house, and that an 8-in. main be carried from the booster direct, without any tappings, a distance of 1700 yards, where a new governor be fixed. The gas will be delivered into the present mains through this governor.

Bailhache Judgment and Gas Company Directors.—The Barnstaple Town Council have met in committee to consider letters from Alderman A. J. Reavell, Chairman of the Finance Committee, who is Deputy Chairman of the Barnstaple Gas Company, and from Mr. F. W. Hunt, who is Chairman of the Company, with reference to their position on the Council consequent on the Bailhache judgment. The Gas Company supply gas to public lamps in those parts of the town where the Council have not their own electric mains, and to public buildings. Mr. W. H. Haddy and Mr. J. C. Isaac, a Director and Secretary respectively of the local Gas Company, are retiring from the Liskeard (Cornwall) Town Council under the Bailhache decision. Mr. Charles Turnbull, the Secretary, and Mr. A. T. Robertson, a Director, of the Alnwick Gas Company, have resigned their seats on the Alnwick Urban District Council, though the former said he was in some doubt as to whether the judgment applied to himself.

GAS REGULATION ACT, 1920.

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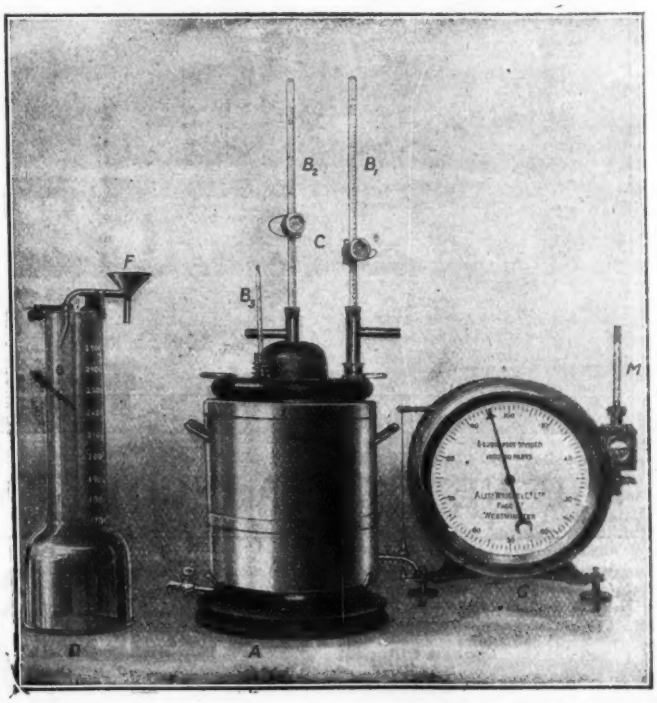


NORTH-EAST COAST COAL TRADE.

From our Own Correspondent.

While Northumberland steams have suffered a still further setback, it can be recorded that Durham coals have had a more cheerful week than for some time past. This is attributable chiefly, no doubt, to a demand that has sprung up in the last fortnight for unscreened bunkers, and, where many collieries can produce steam, gas, or coking coal, such demand for one sort will generally give rise to a better sentiment in the others. Unfortunately the demand appears to have been largely of a temporary nature, due to boats going in ballast to the St. Lawrence for grain cargoes, and taking bunkers for the return journey. At the end of the week there was a distinct slackening in the demand; but useful orders had been booked for best qualities at 19s. 6d. to 20s., against the 18s. basis which had ruled for some weeks.

The better sentiment has been noticeable in second-class gas makes, which have been steadier at 17s. 6d. to 18s. 3d.; better qualities, however, being in no great demand, with specials at 21s. 6d. to 22s. 6d., and bests at 21s. to 21s. 6d.

At the time of writing (Monday), a serious situation has developed at the Dunstan staiths of the L.N.E. Railway Company. Owing to a dispute as to the transfer of men from another shipping place, all teemers and trimmers at Dunstan are on strike, and no coal is being shipped there. Shipments from certain collieries will be seriously interfered with unless a speedy solution is found.

LANCASHIRE AND YORKSHIRE COAL TRADE.

From our Local Correspondent.

The gas coal market in Yorkshire and Lancashire is steady on account of the contracts made during the summer, although "spot" sales are taking place at lower than contract figures.

House coal is in good demand, particularly for the better qualities. Collieries generally report full order books for this description of fuel. This is probably brought about by the fact that industrial coal is not in keen request, and some pits are, therefore, working shorter time. The outlook industrially is not good, and the approaching General Election appears to be having some influence on this branch of the trade. Low figures are quoted for nuts and the smaller steam raising coal.

The shipping outlook is not good, possibly owing to German competition, which, however, should disappear to some extent during the next two months.

The official return shows that during September 404,968 tons of coal entered Hull from the collieries—a decrease of 126,597 tons as compared with September last year. The entry this year up to Sept. 30 was 3,721,235 tons—a decrease on the corresponding period of 1923 of 1,526,220 tons. The export of coal from Hull to coastwise towns amounted to 24,450 tons in September. This year to Sept. 30 the coastwise export was 232,050 tons, against 232,047 tons for the first nine months of last year. Foreign shipments during September (4 weeks) reached 194,693 tons, a decrease of 201,836, and up to Sept. 30 such exports reached 1,789,550 tons—a decrease of 1,482,322 tons.

It was reported at Hull at the week-end that collieries would not take prices forward, upon which business might be done, on account of the political situation and the probable further restriction of output. Best Yorks hards are steady. Nuts and smalls are weak, and so is coke. Prices were: Bunkers—Yorks, Derby, and Notts large screened steam, f.o.b. Humber ports, 18s. to 21s. per ton. Cargo for export, f.o.b., usual shipping ports: Best Yorks hards, Association, 24s. 3d.; Derby best hards, 24s. to 25s.; West Yorks Hartleys, 20s. to 23s.; South Yorks washed doubles, 19s. to 19s. 6d.; singles, 17s. 9d. to 18s. 3d.; dry doubles, 15s. 6d. to 16s. 6d.; South Yorks washed smalls, 15s. 9d. to 16s.; Derby slack, 1 in., 11s.; South Yorks rough slack, 12s. 3d.; gas coke, 32s. to 36s.; foundry furnace coke, 21s. 6d. to 22s.; washed smithy peas, 21s. 6d. to 26s.; washed steam thirds, 19s. 6d.; South Yorks washed trebles, 23s. per ton.

COAL TRADE IN THE MIDLANDS.

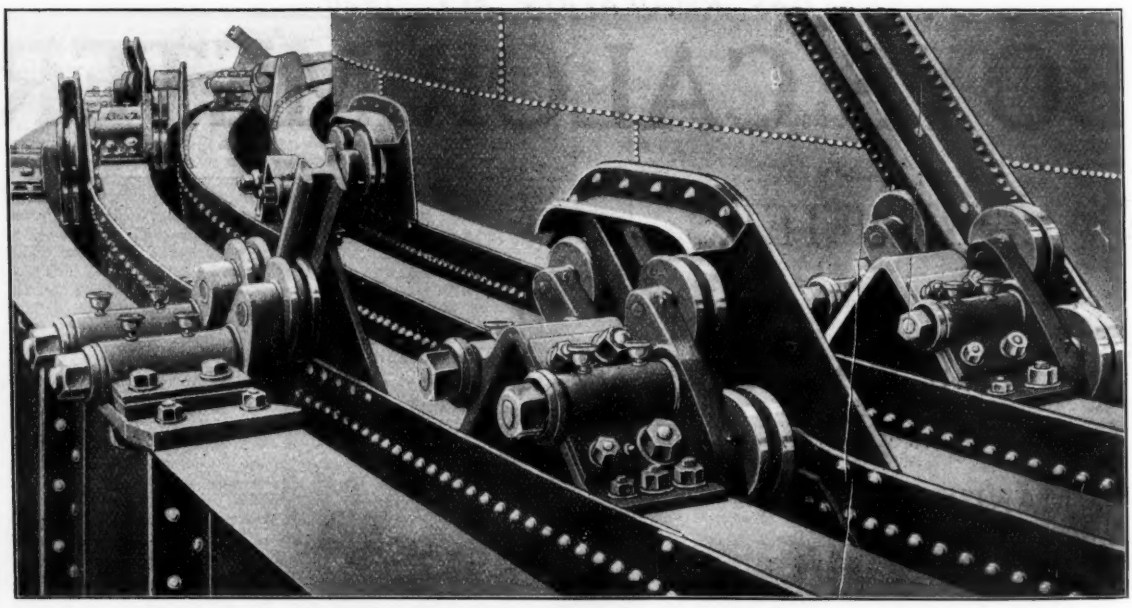
From our Local Correspondent.

The market remains very sluggish, without signs of improvement in any direction. Sellers of gas coal take a pessimistic view of the position so far as it pivots on industrial consumption. The political strife into which the country has been thrown will, it is feared, destroy any chance there was of trade revival this year. With the increase in the lighting load, deliveries are being accepted on a slightly larger scale; but the gorging of the market is shown by the little attention which low-priced spot lots are receiving. Suppliers are looking for freer buying of smalls on account of the electricity undertakings. Thus far orders have come along from that quarter very tardily. There again the explanation is that requirements were anticipated up to the full extent of accommodation in the dead season.

The dullness of the house-coal trade is not relieved. Owing to the comparative inactivity at some of the pits, the position in regard to slacks and smalls is somewhat modified; but there is considerable excess, and opportunities of picking up cheap bargains are plentiful.

Easy market conditions prevail as to furnace coke. South Yorkshire foundry coke is competing strongly for the Birmingham market with that of Derbyshire, supplies being offered at 28s. 6d. delivered.

The Clitheroe Gas Committee have recommended the Town Council to purchase the Chatburn gas undertaking, at present owned by the Bold Venture Lime Company.



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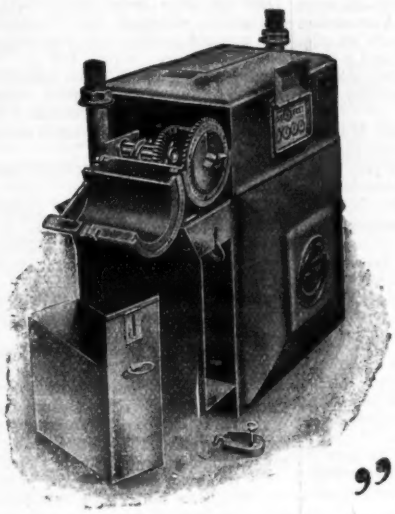

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Oct.* 13.

The market for pitch continues quiet so far as new business is concerned, and the price is nominal at about 50s. to 52s. 6d. per ton. Very large shipments, however, are being made against contracts previously entered into. Fair supplies of tar are still being taken for road work, and a spell of dry weather would mean the sending-out of larger quantities, as a number of surveyors have not yet completed their tarring programmes. Creosote is a steady market at about 6¼d. per gallon net in bulk. Solvent naphtha, 95-160, is about 1s. 6d. per gallon, pure benzole about 1s. 8d. per gallon, and pure toluole about 1s. 10d. per gallon.

Tar Products in the Provinces.

Oct. 13.

The market for tar products has been very quiet during the past week. Pitch has been distinctly depressed, and a considerable business is reported to have been done at 40s. 6d. f.o.b. United Kingdom ports. This confirms the statements made by Continental buyers as to the prices at which they have purchased.

The average values for gas-works products during last week were: Gas-works coal tar, 25s. to 30s. Pitch, East Coast, 40s. to 41s. 6d. f.o.b. West Coast—Manchester, 35s. to 36s.; Liverpool, 36s. to 37s.; Clyde, 37s. 6d. to 38s. 6d. Benzole 90 p.ct., North, 1s. 2d. to 1s. 3d.; crude 65 p.ct. at 120° C., 9d. to 10d. naked at makers' works; 50-90 p.ct., naked, North, 1s. 2d. to 1s. 3d. Toluole, naked, North, 1s. 2d. to 1s. 3d., nominal. Coal tar crude naphtha in bulk, North, 7d. to 7¼d. Solvent naphtha, naked, North, 1s. to 1s. 1d. Heavy naphtha, North, 1s. to 1s. 1d. Creosote, in bulk, North, liquid, 5d. to 5¼d.; salty, 4⅞d. to 5d.; Scotland, 5d. to 5¼d. Heavy oils, in bulk, North, 7d. to 7¼d. Carbolic acid, 60 p.ct., 1s. 7¼d. to 1s. 8¼d. prompt. Naphthalene, £13 to £15; salts, £5 to £7, bags included. Anthracene, "A" quality, 4d. per minimum 40 p.ct., purely nominal; "B" unsaleable.

Reading Gas Company's Debentures Over-Subscribed.—The recent issue of £15,000 of 5 p.ct. redeemable stock by the Reading Gas Company, at the minimum price of par, was considerably over-subscribed.

New Company.—With a capital of £1000, there has been registered Associated Gas Appliances, to carry on business as manufacturers of hardware and gas-works sundries, supplies, and fittings, and engineers. The address is St. Stephens House, Westminster, S.W.

Glasgow Showroom.—At a meeting of the Glasgow Gas Sub-Committee the General Manager reported that the three shops in Victoria Road, Crosshill, recently acquired by the Gas Department for showroom purposes, had been formed into single premises, and that he proposed to lay-out, fit-up, and decorate these premises at an estimated cost of £2600.

Southam Gas Company.—The general meeting of the shareholders of the Southam Gas Company was held last week, Mr. Henry Miles presiding. The accounts and Auditor's report for the past year were submitted by the Secretary (Mr. W. H. Wilson), and adopted. The Directors recommended that dividends of 6 p.ct. on the preference shares and 4 p.ct. on the ordinary shares be paid, and this was approved. It was decided to reduce the price of gas to both ordinary and slot-meter consumers by 5d. per 1000 c.ft., as from the beginning of next year.

Oldbury Gas Main Extensions.—It was reported to the Oldbury Urban District Council last week that the Gas Committee had considered the question of the extension of gas mains within their area, and recommended that application be made to the Minister of Health for sanction to borrow £3000 for the provision of mains for the Warley district, and in order to provide work for the unemployed. They will apply to the Unemployment Grants Committee for a grant towards the cost. In reply to a question, Mr. Wilson (the Chairman of the Gas Committee) gave a statement as to the consumption of gas by industrial and non-industrial users. This showed 37 p.ct. industrial and 63 p.ct. non-industrial. The report was adopted.

Fused Wire Results in Gas Explosion.—The shop at which a chemist's business is carried on by Mr. J. H. Robinson, under the Exchange Station Hotel, in Tithebarn Street, Liverpool, was the scene of an explosion last week. A large plate-glass window forming the front portion of the establishment was shattered, and fragments were blown in all directions, while the coal grid was dislodged from its position in the pavement and hurled some distance away, as also was the heavy iron cover of a manhole at the front of the shop. Some of the contents of the shop were also damaged. Subsequent investigation pointed to the fact that the explosion was due to a leaking water-pipe fusing an electric main. This in turn came into contact with the gas meter and caused an escape of gas, which exploded.

Fatal Gas Explosion at Swansea.—One youth was killed and a number of persons were removed to hospital as the result of a gas explosion which occurred shortly after one o'clock last Wednesday afternoon in a block of offices at Swansea occupied by Messrs. Arthur M. James & Co., solicitors. "It appears," said a local paper, "that a load of coal was being tipped into the cellar of Messrs. James' offices. The caretaker, Mrs. Davies, who resides at the top of the building, was in the cellar at the time with a lighted candle, while the coal was being tipped down. It appears that in some way or other a gas main was broken by (it is surmised) the falling coal." Brimley Rees was in the street with his cycle at the time, and was probably struck on the head by flying debris. The inquest was opened on Friday, and after evidence of identification had been taken, was adjourned for six weeks, to allow time for the recovery of certain important witnesses. Mr. J. C. Wood, on behalf of the Gas Company, expressed sympathy with all the victims. The actual cause of the explosion still seems a matter of conjecture, but it is said to have been pretty clearly established that it was not caused by the carrying of a lighted candle into the coal cellar.

STOCK MARKET REPORT.

The uncertainty of political events still overshadowed the markets at the commencement of last week and reduced the volume of business. There was no pressure to sell, in spite of the fact that prices were marked down in anticipation of this event, but a general disinclination to buy. Later, on the dissolution of Parliament, the decision to hold a prompt General Election gave a distinct fillip to the Stock Markets, and prices hardened.

British Funds remained firm, and some fractional advances were recorded. Five p.ct. War Loan closed at 102$\frac{7}{16}$, and a few dealings were put through up to 102$\frac{1}{2}$, the 3$\frac{1}{2}$ p.ct. Conversion Loan finished at 77$\frac{3}{4}$, and the 4$\frac{1}{2}$ p.ct. at 98$\frac{1}{2}$. Dealings in the £4,000,000 Queensland 5 p.ct. Loan, which was oversubscribed, commenced on Thursday, and closed at the end of the week at about $\frac{3}{8}$ premium.

In the Industrial and Miscellaneous Markets business was irregular. Textiles were slightly lower on balance; Bradford Dyers and Bleachers being an exception. Considerable profit taking was apparent in the Tea Market, and at the end of the week further heavy buying was reported. Oils were again active—Mexican Eagle still the dominating feature.

The Gas Market maintains a strong tone. Dealings have been particularly heavy, and variations, although few in number, were on the upward grade, with the exception of Gas Light ordinary, which fell $\frac{1}{4}$. Primitiva ordinary advanced 9d., a net gain of 2s. 6d. since the beginning of the month. Other increases were recorded by Bournemouth "B," Brighton, Montevideo, and on the home exchanges Liverpool and Newcastle.

The following transactions were recorded during the week:

On Monday, Alliance and Dublin 64$\frac{1}{8}$, 65$\frac{11}{16}$, *ex* div., Brentford "A" 112$\frac{1}{2}$, "B" 112, 112$\frac{1}{2}$, 113$\frac{1}{4}$, Commercial 3 p.ct. debenture 57$\frac{1}{4}$, European 8$\frac{1}{4}$, Gas Light and Coke 95, 95$\frac{1}{8}$, 95$\frac{1}{4}$, 95$\frac{3}{8}$, 95$\frac{1}{2}$, 95$\frac{5}{8}$, 96, 3$\frac{1}{2}$ p.ct. maximum 62$\frac{3}{4}$, 4 p.ct. preference 79$\frac{3}{8}$, 80, 3 p.ct. debenture 61, Hastings and St. Leonards 3$\frac{1}{2}$ p.ct. 78$\frac{1}{2}$, Imperial Continental 173, 173$\frac{1}{2}$, 174$\frac{1}{2}$, 175, Lea Bridge 97, Montevideo 59, Primitiva 9s., 9s. 1$\frac{1}{4}$d., 9s. 3d. 9s. 4$\frac{1}{2}$d., 9s. 6d., South Metropolitan 99$\frac{1}{2}$, 99$\frac{3}{8}$, 99$\frac{3}{4}$, South Suburban 5 p.ct. 104, Tottenham "B" 101, 4 p.ct. debenture 77, Wandsworth 3 p.ct. debenture 57. Supplementary prices, Hampton Court 5 p.ct. 105$\frac{3}{8}$, 105$\frac{7}{8}$, Kingston-upon-Thames, 105$\frac{7}{8}$.

On Tuesday, Brentford "A" 113, "B" 112$\frac{1}{2}$, 113, Brighton and Hove 172, British 117$\frac{1}{4}$ *ex* div., Continental Union 7 p.ct. preference 91, 91$\frac{1}{2}$, European 8$\frac{1}{4}$, 8$\frac{5}{16}$, Gas Light and Coke 95, 95$\frac{1}{8}$, 95$\frac{1}{4}$, 95$\frac{3}{8}$, 95$\frac{5}{8}$, 3$\frac{1}{2}$ p.ct. maximum 62$\frac{1}{2}$, 4 p.ct. preference 80, Imperial Continental 173, 173$\frac{1}{2}$, 174, 174$\frac{1}{2}$, Montevideo 57, Primitiva 9s., 9s. 3d., 9s. 4$\frac{1}{2}$d., 9s. 6d., 9s. 7$\frac{1}{2}$d, South Metropolitan 99$\frac{1}{2}$, 3 p.ct. debenture 60$\frac{1}{2}$, 61$\frac{1}{2}$, Southampton 5 p.ct. maximum 87, Tottenham "B" 101, 101$\frac{1}{8}$, 101$\frac{1}{2}$, 4 p.ct. debenture 78. Supplementary prices, Gas Light and Coke 10 p.ct. Bonds 190$\frac{1}{2}$.

On Wednesday, Alliance and Dublin 4 p.ct. debenture 65$\frac{1}{2}$, Bournemouth 5 p.ct. 12$\frac{15}{16}$, "B" 112$\frac{13}{16}$, 112$\frac{15}{16}$, Brentford "A" 112, 112$\frac{1}{2}$, British 118 *ex* div., Gas Light and Coke 95, 95$\frac{1}{8}$, 95$\frac{3}{8}$, 95$\frac{1}{2}$, 4 p.ct. preference 80, Imperial Continental 172, 174$\frac{1}{2}$, Primitiva 9s. 6d., 9s. 7$\frac{1}{2}$d., 9s. 9d., 4 p.ct. (Buenos Ayres) new debenture 57, South Metropolitan 99$\frac{1}{4}$, 99$\frac{3}{8}$, 99$\frac{5}{8}$, South Suburban 5 p.ct. 103$\frac{1}{2}$, 105.

On Thursday, Alliance and Dublin 4 p.ct. debenture 65$\frac{7}{8}$, Bahia-Blanca "A" 3s. 9d., Bournemouth "B" 12$\frac{3}{4}$, Brighton and Hove 174, 175, Cape Town 4$\frac{1}{2}$ p.ct. preference 6$\frac{1}{2}$, Croydon sliding-scale 102, 103, maximum dividend 85$\frac{1}{2}$, Gas Light and Coke 95, 95$\frac{1}{8}$, 95$\frac{1}{2}$, 4 p.ct. preference 80, 3 p.ct. debenture 60$\frac{3}{4}$, 62, Imperial Continental 174, 3$\frac{1}{2}$ p.ct. debenture 71, 71$\frac{1}{2}$, Montevideo 60, Primitiva 9s. 7$\frac{1}{2}$d., 9s. 9d., 9s. 10$\frac{1}{2}$d., 10s., 10s. 1$\frac{1}{2}$d., 10s. 3d., South Metropolitan 99, 99$\frac{1}{8}$, 99$\frac{3}{4}$, 3 p.ct. debenture 61$\frac{1}{4}$, South Suburban 5 p.ct. 104$\frac{1}{2}$, 5 p.ct. debenture 96$\frac{1}{2}$, Tottenham "A" 117.

On Friday, Cape Town 4$\frac{1}{2}$ p.ct. preference 6$\frac{1}{2}$, Cardiff 99$\frac{1}{2}$, Croydon maximum dividend 85$\frac{1}{2}$, European 8$\frac{3}{8}$, Gas Light and Coke 94$\frac{1}{2}$, 94$\frac{5}{8}$, 94$\frac{3}{4}$, 94$\frac{7}{8}$, 95, 95$\frac{1}{8}$, 95$\frac{1}{4}$, 3$\frac{1}{2}$ p.ct. maximum 62, 4 p.ct. preference 80, Imperial Continental 172$\frac{1}{2}$, 173$\frac{1}{2}$, 3$\frac{1}{2}$ p.ct. debenture 70, Primitiva 9s. 7$\frac{1}{2}$d., 9s. 10$\frac{1}{2}$d., 10s., 10s. 1$\frac{1}{2}$d., 10s. 3d., 4 p.ct. debenture (1911) 55$\frac{1}{2}$, South Metropolitan 99$\frac{1}{4}$, South Suburban 5 p.ct. debenture 98. Supplementary prices, Wandsworth 3$\frac{1}{2}$ p.ct. new 99.

In the Money Market conditions generally were in favour of borrowers; money being plentiful. The highest rate for either old or new day-to-day loans was 2$\frac{1}{2}$ p.ct., and large sums were offered down to 2 p.ct.; some balances being obtainable at an even lower rate than this. Treasury Bills were issued on Friday at an average rate of £3 13s. 9·13d. p.ct., compared with £3 14s. 3·89d. the previous week.

The outstanding feature of the Foreign Exchange Market was the advance in sterling; the closing quotation being 4.49$\frac{1}{2}$, against 4.46$\frac{5}{16}$ last week. French francs closed at 86.32$\frac{1}{2}$, and the Belgian rate at 93.85.

The Bank rate is 4 p.ct., to which it was raised from 3 p.ct. on July 5, 1923. Bankers' deposit rates are 2 p.ct. The deposit rates of discount houses are 2 p.ct. at call and 2$\frac{1}{2}$ p.ct. at notice.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Oct. 10.	Rise + or Fall − on Week.	Transactions Lowest and Highest Prices.
£			% p.a.	% p.a.				
171,978	Stk.	Aug. 14	5	5	Aldershot 5 p.c. max. C.	80—83	..	..
235,492	,,	,,	4	4	Do. 4 p.c. Pref.	68—72	..	..
1,551,868	,,	Sept. 25	6	6½	Alliance & Dublin Ord.	61—66	..	64¼—64⅝
374,000	,,	July 10	4	4	Do. 4 p.c. Deb.	63—68	..	65⅛—65⅝
300,000	5	May 22	8	8	Bombay, Ltd.	5—5½	..	..
100,000	10	Aug. 14	8½	8½	Bournemouth 5 p.c.	12½—13¼	..	12$\frac{13}{16}$
383,110	10	,,	7	7	Do. B 7 p.c.	12½—13	+⅛	12⅛—12$\frac{15}{16}$
150,000	10	,,	6	6	Do. Pref. 6 p.c.	10½—11¼	..	..
50,000	Stk.	June 26	3	3	Do. 3 p.c. Deb.	54—59	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	74—79	..	..
992,045	,,	July 10	6$\frac{1}{10}$	6$\frac{1}{10}$	Brentford A Con.	110—115	..	112—113
990,500	,,	,,	6$\frac{2}{5}$	6$\frac{2}{5}$	Do. B New	110—115	..	112—113¼
76,000	,,	,,	5	5	Do. 5 p.c. Pref.	87—92	..	..
306,690	,,	June 12	4	4	Do. 4 p.c. Deb.	75—80	..	..
181,337	,,	,,	—	6	Do. 6 p.c. Rich. Red. Deb.	100—105	..	..
214,740	,,	Aug. 28	11½	11½	Brighton & Hove Orig.	170—175	+3	172—175
244,200	,,	,,	8½	8½	Do. A Ord.	125—128	+2	..
1,287,500	,,	July 24	5	5	Bristol 5 p.c. max.	91—92*a*	..	..
855,000	,,	Sept. 25	7	8	British Ord.	115—120	..	117½—118
100,000	,,	June 26	7	7	Do. 7 p.c. Pref.	118—123	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	72—77	..	..
100,000	10	May 22	6	8	Cape Town, Ltd.	6½—7½	..	..
100,000	10	Apr. 24	4½	4½	Do. 4½ p.c. Pref.	6—7	..	6½—6½
150,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb.	71—76	..	..
626,860	,,	July 24	6	6	Cardiff Con. Ord.	97—100	..	99½
237,860	,,	June 26	7½	7½	Do. 7½ p.c. Red. Deb.	103—106	..	..
157,150	,,	Aug. 14	6½	5	Chester 5 p.c. Ord.	86—91*b*	..	..
1,513,280	,,	July 24	6	6	Commercial 4 p.c. Cap.	91—94	..	..
560,000	,,	,,	6	6	Do. 3½ p.c. Cap.	91—94	..	..
475,000	,,	June 12	3	3	Do. 3 p.c. Deb.	56—59	..	57½
800,000	,,	14 Jan. 15	—	—	Continental Union, Ltd.	38—43	..	..
200,000	,,	June 12	7	7	Do. 7 p.c. Pref.	87—92	..	91—91½
660,000	,,	Aug. 28	6½	6½	Croydon sliding scale	100—103	..	102—103
284,975	,,	,,	5	5	Do. max. div.	84—87	..	85½
492,270	,,	Aug. 28	9	6	Derby Con.	107—110	..	..
55,000	,,	July 10	4	4	Do. Deb.	74—76*c*	..	..
309,000	,,	Oct. 9	5	5	East Hull 5 p.c. max.	*	..	..
1,002,180	10	July 24	2	6	European, Ltd.	7½—8½	..	8$\frac{3}{16}$—8⅝
16,503,045	Stk.	Aug. 14	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	94—96	−½	94¼—96
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	61—64	..	62—62½
4,062,235	,,	,,	4	4	Do. 4 p.c. Con. Pref.	78—81	..	79½—80
4,761,930	,,	June 12	3	3	Do. 3 p.c. Con. Deb.	60—63	..	60¾—62
130,000	,,	—	10	10	Do. 10 p.c. Bonds	..	..	190½
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
82,500	,,	Sept. 11	6⅝	6⅝	Hastings & St. L. 5 p.c. Conv.	95—100	..	..
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	75—80	..	78½
70,000	10	Sept. 25	10	10	Hongkong & China, Ltd.	15½—16½	..	..
86,600	Stk.	Aug. 14	10	10	Hornsey 7 p.c.	138—143	..	..
1,976,000	,,	May 22	10	30	Imperial Continental Cap.	172—177	..	172—175
263,950	,,	Aug. 14	3½	3½	Do. 3½ p.c. Red. Deb.	68—71	..	70—71½
235,242	,,	Aug. 14	6½	6½	Lea Bridge 5 p.c. Ord.	95—100	..	97
2,127,340	,,	Aug. 14	5½	5½	Liverpool 5 p.c. Ord.	91—92*b*	+2	..
600,000	,,	Sept. 25	7	7	Do. 7 p.c. Red. Pref.	102—105*b*	..	..
165,736	,,	Aug. 28	8	9	Maidstone 5 p.c. Cap.	120—125	..	..
63,480	,,	June 26	3	3	Do. 3 p.c. Deb.	53—58	..	..
75,000	5	,,	5	7	Malta & Mediterranean	3½—3¾	..	..
541,920	Stk.	June 12	4	4	Montevideo, Ltd.	55—60	+1	57—60
1,875,892	,,	July 24	5½	5	Newcastle & Gateshead Con.	82½—83½*d*	+½	..
250,166	,,	,,	4	4	Do. 4 p.c. Pref.	74—75*d*	..	..
529,705	,,	June 26	3½	3½	Do. 3½ p.c. Deb.	70—72*d*	..	..
15,000	10	Aug. 28	11	11	North Middlesex 10 p.c.	15½—16½	..	..
75,940	10	,,	7$\frac{7}{10}$	7$\frac{7}{10}$	Do. 7 p.c.	11—11½	..	..
300,000	Stk.	May 8	9	7	Oriental, Ltd.	99—102	..	..
138,120	,,	June 26	7⅞	7⅞	Plym'th & Ston'house 5 p.c.	112—117	..	..
60,000	50	Aug. 28	13	13	Portsea Island B	99—102	..	..
100,000	50	,,	12	12	Do. C	95—100	..	..
2,289,909	1	—	—	—	Primitiva Ord.	9/6—10/6	+/9	9/- —10/3
341,400	100	June 2	4	4	Do. 4 p.c. Red. Deb.	76—79	..	..
600,000	Stk.	July 24	4	4	Do. 4 p.c. Red. Deb. 1911	53—56	..	55½
220,335	,,	June 26	4	4	Do. B. Aires 4 p.c. Rd. Db.	54—57	..	57
321,670	,,	,,	4	4	Do. R'r P'te 4 p.c. Rd. Db.	54—57	..	..
150,000	10	Sept. 25	6	6	San Paulo 6 p.c. Pref.	6¾—7½	..	..
125,000	50	July 1	5	5	Do. 5 p.c. Red. Deb.	41—43	..	..
270,000	Stk.	Aug. 28	5/8/4	5½	Sheffield A	101—103*e*	..	..
419,968	,,	,,	5/8/4	5½	Do. B	101—103*e*	..	..
1,047,000	,,	,,	5/8/4	5½	Do. C	101—103*e*	..	..
90,000	10	June 12	6	8	South African	7—9	..	..
6,609,895	Stk.	Aug. 14	6½	5	South Met. Ord.	98½—100½	..	99—99¾
102,580	,,	July 10	5	5	Do. Red Pref.	96—98	..	..
1,895,445	,,	,,	3	3	Do. 3 p.c. Deb.	59—62	..	60½—61½
734,000	,,	Sept. 11	6½	6½	Do. 6½ p.c. Red. Deb.	101—103	..	..
91,500	,,	Aug. 28	8½	8½	South Shields Con.	134—136*d*	..	..
1,087,795	,,	Aug. 14	6½	6½	South Suburban Ord. 5 p.c.	103—106	..	103½—105
368,837	,,	June 26	5	5	Do. 5 p.c. Deb.	93—98	..	96½—98
647,740	,,	May 8	5	5	South'mpt'n Ord. 5 p.c. max.	85—88	..	87
121,275	,,	June 26	4	4	Do. 4 p.c. Deb.	73—78	..	..
250,000	,,	Aug. 28	7	7	Swansea 7 p.c. Red. Pref.	101½—103½	..	..
200,000	,,	June 26	6½	6½	Do. 6½ p.c. Red. Deb.	102—104	..	..
120,000	,,	July 24	8	8	Tottenham District A 5 p.c.	116—119	..	117
882,275	,,	,,	6½	6½	Do. B 3½ p.c.	99—102	..	101—101½
181,255	,,	June 12	4	4	Do. 4 p.c. Deb.	76—80	..	77—78
258,251	,,	Aug. 28	7/14/4	5	Tynemouth Con. and New Wandsworth, Wimbledon, and Epsom—	84—86*d*	..	..
30,000	,,	July 10	9½	9½	Wandsworth A 5 p.c.	135—140	..	..
255,636	,,	,,	7½	7½	Do. B 3½ p.c.	113—118	..	..
108,075	,,	,,	6/7/9	6/9/6	Do. C	96—101	..	..
240,865	,,	,,	6/7/9	6/9/6	New Ordinary	..	..	99
352,000	,,	,,	7½	7½	Wimbledon 5 p.ct.	110—115	..	..
98,000	,,	,,	7½	7½	Epsom 5 p.ct.	115—120	..	..
88,416	,,	June 26	3	3	3 p.c. Deb.	55—60	..	57

Quotations at:—*a*.—Bristol, *b*.—Liverpool. *c*.—Nottingham. *d*.—Newcastle. *e*.—Sheffield. * Ex. div.

Coke-Oven Gas at Middlesbrough.—Messrs. Dorman, Long & Co. have advised the Middlesbrough Corporation that they are prepared to grant an extension of the agreement for the supply of coke-oven gas from the Newport Ironworks for a period of three years on the same terms as at present. The matter has been left in the hands of the Chairman of the Gas Committee (Alderman Sir Joseph Calvert).

Gas Showrooms at Brierley Hill.—The Brierley Hill Gas Company have opened a well-equipped showroom in High Street, Brierley Hill. Mr. W. C. Jones (Manager) at the opening ceremony on Friday last, pointed out that its provision was to increase the efficiency of the gas service in the district. Mr. Theedam (Dudley Gas Light Company) emphasized the importance of spreading knowledge of gas and its many applications.

Irish Lighting Dispute.—The Gorey (Co. Wexford) Town Council having terminated their contract for street lighting with the local Gas Company, deciding to use petrol lamps, proceeded to put the latter on the gas standards. Thereupon the employees of the Gas Company removed them, on the ground that the standards are the property of Company. The ownership of the standards is now to be the subject of litigation, and meantime the streets remain unlighted.

Skipton and the Gargrave Gas Supply.—A Ministry of Health inquiry took place at Skipton last week into the Council's application to borrow £7000 in connection with the taking of a gas supply to Gargrave. Major J. Stewart, O.B.E., R.E., was the Inspector. It was stated that Gargrave, which is some four miles from Skipton, is at present dependent for gas on the Gargrave Mill Company, who have been unable to supply at a profit, but are guaranteed against loss by the Skipton Council. The work of laying the main between Skipton and Gargrave has begun. There was no opposition to the proposal.

Station Lighting by Gas.—An important lighting improvement has been carried out by the Birmingham Gas Department at the New Street Station, Birmingham. Lamps have been installed with distance control, and the lights can be lighted or extinguished from a central point. Low-pressure gas is being used for the illumination of the platforms, yards, and subways; and the lamps embody the principle of superheated clusters of small inverted mantles. In the station the lamps are suspended from the roof tie-rods. Thus, obstructive lamp standards on the platforms are dispensed with. The offices and waiting-rooms are lighted by electricity.

Derbyshire Coke-Oven Workers' Dispute.—The wages dispute among the men employed at the Holbrook Colliery Coke Ovens still remains unsettled, despite several conferences that have been held to arrange matters. The men, who belong to the National Union, asked for an all-round advance of 9d. a shift. At present the lowest paid men receive 5s. 9d., and the highest 7s. 9d. per shift. A conference took place on Friday, but no agreement was reached. At the request of the Company, notices have been suspended for seven days, in order that the gas supply to the public may not be interfered with. In the meantime it is expected that an amicable settlement will be reached.

Stamford Public Lighting.—At the last meeting of the Stamford Town Council, when the tender of the Gas Company to light the street lamps from Sept. 6 to May 2, 1925, was accepted for £570, Alderman Bell expressed the view that the Council had been hardly dealt with by the Company. He thought they were entitled to a considerable reduction of the present high figures, especially considering the smaller number of hours the lamps were burning compared with former days, and the fact that the Company were only required to light the lamps for six months, instead of twelve. Mr. Chapman stated that, as a member of the Committee dealing with the figures, he had gone into the matter, and he felt satisfied that the Council were obtaining full value for the money paid.

It was reported at a meeting of the Letterkenny (Co. Donegal) Urban Council that no account could be given of 30 p.ct. of the gas consumed in the town during the summer quarter. Further investigation is, however, being made.

The Coleraine (Co. Londonderry) Urban Council have decided to reduce the price of gas from 5s. to 4s. 7d. per 1000 c.ft., and the Gas Committee have been instructed to consider the question of a preferential rate for power users.

A shopping week is in progress at Aldershot this week; and in the Shopping Week Supplement of the "Aldershot News," the Aldershot Gas, Water, and District Lighting Company have an advertisement, in which are pointed out the advantages of heating by gas.

During last week's stormy weather, large districts in Cornwall were flooded. Helston suffered considerably, especially in the lower part of the town, where the gas-works are situated; the fires being extinguished by the rising water, and some inconvenience caused.

The Withnell District Council, on Oct. 9, decided upon a reduction in the price of gas from 4s. 9d. to 4s. 6d. per 1000 c.ft. for ordinary consumers, and a discount of 2d. in the 1s. for prepayment users. The price of coke to consumers outside Withnell is to be raised from 30s. to 30s. 10d. per ton at the gas-works.

The Pontypridd Urban District Council, who own both the electricity and gas undertakings, have decided to instal electricity for the lighting of 60 houses in course of erection, and gas for cooking, and also to instal gas where required for cooking and heating in the existing 110 dwellings of their housing scheme.

Early on Friday morning a fire was discovered in the pattern shop of Messrs. R. & J. Dempster, Ltd., Manchester. The fire appliances were quickly to hand, and the injury was confined to a portion of the shop and contents beneath. This will cause temporary inconvenience, which will be largely minimized owing to the fact that the work can be transferred to a new joiners' shop—one of the recent extensions of the firm.

The old gas undertaking at Billington and Langho, originally established by Messrs. S. Longworth and Sons, cotton manufacturers, which was transferred to the Whalley Gas Lighting Company, has now been acquired by the Accrington District Gas Board, who henceforward will supply the district from their Great Harwood Works. A large holder has been placed in Sandy Brow, Whalley, for the purpose. Thus, for the first time, Billington will enjoy a gas supply, and the whole of the thoroughfare from Whalley to Blackburn will soon be lighted.

It was stated at a meeting of the Brownhills Urban District Council last week that, since the Housing Committee had decided to have the electric light installed in the Council houses now being erected at Shire Oak, a letter had been received from the local Gas Company offering to lay a length of main and instal two lights and a gas stove in each of the 100 houses free of charge, on condition that no one else was allowed to compete with them on the estate for five years. The Cannock Chase Colliery Company, on the other hand, would, on rebate terms, fix two electric lamps in each of the houses for nothing, and the fittings would be the Council's own property when once fixed by the Company. The Company would put in sixpenny and shilling slot-meters in the houses, with a cost per unit of 11d. or 1s.; but if the Council had the houses wired, the tenants would be able to have the current at 8d. per unit. It was stated that if three extra electric lamps were installed, the cost to the Council for the 100 houses would be £225; while if three extra gas lights were put in, the cost to the Council would be £75. After a considerable discussion the matter was deferred until a conference had been held with representatives of the Gas Company, the Colliery Company, and the Housing contractor.

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(See Article in "JOURNAL," May 21, p. 523.)

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